WATER QUALITY

Water in its natural state is never completely pure. Even rain gathers impurities as it falls through the atmosphere. Man has learned from experience that good quality water is conducive to good health and accordingly has attempted to obtain water of a high quality and has fancied himself as knowing good water from bad merely by its appearance. Water's appearance, however, can be deceiving and stagnant swamp water may be of good quality and safe to drink while, ironically, a sparkling stream may carry disease-causing organisms.

Of all the future water problems relating to distribution, variability, supply, and quality, those associated with quality appear to be the most troublesome. As man's activities degrade the water in various ways, people have increasing difficulty differentiating between naturally poor water and contaminated water. Although in many parts of the nation water has always been of poor quality, the ground water and surface water in the Nooksack River basin is of excellent quality and available in large quantities. This quality, however, must be protected and in order to be preserved, the present quality must first be determined.

Quality data pertaining to ground water were collected by the U. S. Geological Survey in 1949 and the Division of Water Resources in 1960. In addition, limited privately analyzed data are available. The necessary background for obtaining quality information for surface water was begun in July, 1959, when the U. S. Geological Survey in cooperation with the Pollution Control Commission, State Health Department, and Division of Water Resources established a quality sampling station for the Nooksack River at Nugent's Bridge near Lawrence. This station is part of the state-wide network to collect basic data on the quality of Washington's water. Daily samples have been collected here since September 1, 1959; and the analysis of these samples, together with additional spot or grab samples by the U. S. Geological Survey, the State Pollution Control Commission, the Division of Water Resources, and private corporations, comprises the technical data predicating this chapter. The State Health Department provided background information, and the Whatcom County Department of Public Health assisted in the collection of data as well as providing data of past years' quality.

It is important to remember that a quality analysis indicates only what the condition is at a specific time and, thus, should be used in conjunction with a sanitary survey if accurate information is sought to resolve a specific problem. There are five types of quality tests commonly used to analyze water. These are the bacteriological, chemical, physical, sanitary, and biological tests that are discussed on the following pages.

STANDARDS

Certain standards of quality have been established for hygienic, aesthetic, and industrial purposes. There are almost as many standards as there are uses of water, so of necessity, only the most common and widely accepted are discussed here.

Table 34 summarizes the U. S. Public Health Service's bacteriological requirements which are used by the State of Washington, Department of Health, and are commonly accepted throughout the United States as the standard for potable water for public supplies.

Table 34. U. S. Public Health Service Drinking Water Standards for Bacteriological Quality.

Sample size	Number of test portions per sample	Maximum % of portions showing coliform bacteria	Maximum % or samples showing 3 or more portions positive per month
50 ml	5	10	5% (when 20 or more samples per month) 1 sample (when less than 20 per month)
500 ml	5	60	20% (when 5 or more samples per month) 1 sample (when less than 5 per month)

Table 35. U. S. Public Health Service Drinking Water Standards for Chemical Quality.

CONSTITUENT	MAXIMUM ALLOWABLE CONCENTRATION parts per million	
	Mandatory	Recommended
Arsenic	0.05	
Hexavalent Chromium	0.05	
Fluoride	1.5	
Lead	0.1	
Selenium	0.05	
Chloride		250.0
Copper		3.0
Iron & Manganese (total)		0.3
Magnesium		125.0
Phenolic Compounds		0.001
Sulfate		250.0
Zinc		15.0
Total Solids		500 (1000 permitted if better not available)

The U. S. Public Health Service has also established chemical standards for potable water which are listed in table 35. Following recent concern through the nation regarding

Table 36. Suggested Water Quality Tolerances.

(Allowable limits in parts per million. Source of Data: E. W. Moore, (1940) Journal New England Water Works Association, Volume 54. Potable water conforming to U. S. Public Health Service standards is necessary. Iron as Fe limit given, applies to both iron alone and the sum of iron and manganese)

Industry or use	Turbidity	Color	Hardness as $CaCO_3$	Iron as Fe	Manganese as Mn	Total solids	Alkalinity as $CaCO_3$	Odor and taste	Hydrogen sulfide	Health requirement
Air conditioning				0.5	0.5			Low	1	
Baking	10	10		0.2	0.2			Low	0.2	Potable
Boiler feed										
Brewing:										
Light beer	10			0.1	0.1	500	75	Low	0.2	Potable
Dark beer	10			0.1	0.1	1,000	150	Low	0.2	Potable
Canning:										
Legumes	10		25 -75	0.2	0.2			Low	1	Potable
General	10			0.2	0.2			Low	1	Potable
Carbonated beverages	2	10	250	(0.2) (0.3)	0.2	850	50-100	Low	0.2	Potable
Confectionery				0.2	0.2	100		Low	0.2	Potable
Cooling	50		50	0.5	0.5			Low	5	
Food: General	10			0.2	0.2			Low		Potable
Ice	5	5		0.2	0.2			Low		Potable
Laundering			50	0.2	0.2					
Plastics, clear, uncolored	2	2		0.2	0.02	200				
Paper and pulp:										
Groundwood	50	20	180	1.0	0.5					
Kraft pulp	25	15	100	0.2	0.1	300				
Soda and sulfite	15	10	100	0.1	0.05	200				
High-grade light papers	5	5	50	0.1	0.05	200				
Rayon (viscose):										
Pulp production	5	5	8	0.05	0.03	100	Total 50; hydroxide 8			
Manufacture	0.3		55	0	0					
Tanning	20	10-100	50-135	0.2	0.2		Total 135; hydroxide 8			
Textiles: General	5	20		0.25	0.25					
Dyeing	5	5-20		0.25	0.25	200				
Wool scouring		70		1.0	1.0					
Cotton bandage	5	5		0.2	0.2			Low		

excessive nitrates in water, the State Department of Health has adopted a concentration of 10 parts per million of nitrogen in the form of nitrate or a total of 44.2 parts per million nitrate as a recommended maximum since no nitrate limitation has, as yet, been adopted by the Public Health Service. The State Department of Health conducts further investigations when greater concentrations of nitrogen than this are found.

In addition to these hygienic requirements, many industries have further restrictions concerning their use of water. Suggested water quality tolerances for several industries are listed in table 36 and exemplify the difficulty of obtaining suitable water for all uses. Because of these varying tolerances no one supply can be suitable for all uses.

Physical standards for potable water have been established by the U. S. Public Health Service and are outlined in table 37. Several physical tolerances for various industries are listed in table 36.

Table 37. U. S. Public Health Service Drinking Water Standards for Physical Quality.

Property	Requirements
Turbidity	10 ppm (maximum)
Color	20 ppm (maximum)
Taste	Not objectionable
Odor	Not objectionable

Although both the sanitary and biological tests of water are very important, no generally accepted standards have been established for a determination of their quality and, therefore, each situation must be considered individually.

PRESENT QUALITY

BACTERIOLOGICAL

The primary purposes for bacteriological testing are to determine whether water is safe for human consumption and delineate areas of pathogenic contamination. The test is used to determine the presence of coliform bacteria such as Escherichia coli, and a positive sample is one in which these bacteria are present. The coliform bacteria themselves do not cause illness in concentrations commonly found in drinking water. However, they are indicative of contamination and their presence in appreciable numbers indicates that the water contains diluted human wastes or sewage and likely carries disease-causing organisms and is, therefore, not safe for human consumption without adequate treatment.

Table 38 contains the bacteriological results of three years of tests for municipal and community domestic water systems in the study area which were tested during 1957, 1958, and 1959. Comparison of table 38 with table 34 indicates whether a system corresponds to the Public Health Service requirements for approved supplies. However, additional factors such as sampling frequency and a sanitary survey must be considered before approving any supply for public use. All cities should collect at least one bacteriological sample per month, and the Whatcom County Health Department has adopted a policy of trying to collect at least one sample per year from every community supply. Sources indicating contamination are, of course, sampled more frequently.

Table 38 shows that many of the water associations have not maintained a recommended sampling frequency of at least one sample per year. The large number of positive samples for the systems utilizing surface supplies also accentuates the need for continuous chlorination of these supplies. Essentially, however, the basin's water is of excellent quality from a bacteriological standpoint and, with a minimum of treatment, is suitable for domestic supplies.

CHEMICAL

A chemical analysis, often called a mineral test, is used to determine the inorganic or mineral constituents of water. In making this analysis the chemist tests for arsenic, boron, carbonate, bicarbonate, calcium, chloride, copper, fluoride, iron, lead, magnesium, manganese, nitrate, potassium, silica, sodium, sulfate, and zinc. The analysis also includes determinations of alkalinity, hardness, pH, radioactivity, and the specific electrical conductance.

GROUND WATER

The ground waters of the Nooksack River basin are relatively low in dissolved solids although they are more highly mineralized than the surface waters. They are generally of good quality, although ground water of poor quality does occur in small areas of generally good quality water. The quality in most cases depends mainly upon the geologic mode of occurrence. The majority of waters can be classified as calcium-magnesium-bicarbonate type. However, sodium bicarbonate, sodium sulfate, sodium chloride, and mixed-type waters are also present. In studying the mineral content of the ground water, relatively complete chemical analyses were made on twenty-five representative wells located throughout the Whatcom Basin (tab. 39). In addition, analyses of the city of Everson well (40/3-36H1), the city of Blaine spring (40/1-3M1) and artesian well (41/1-31Q1) were furnished by city water department officials.

Hardness.

Of the field hardness determinations, the greatest found in the Nooksack River basin was 1,500 parts per million from an artesian well owned by K. VanderGriend (40/3-28M). This well, drilled in 1910 to a depth of 375 feet, apparently obtains saline water from the Tertiary and/or early Pleistocene marine sediments which underlie the younger glacial deposits in the Whatcom Basin. The softest water with a hardness of 36 parts per million (Northwood Springs, 40/3-15H1) comes from recessional outwash gravels overlying Vashon till. Of 246 wells and springs tested for hardness by the U. S. Geological Survey, 31 percent had soft water, 39 percent had slightly hard water, 27 percent had moderately hard water, and 3 percent had very hard water. Wells in the Vashon till yielded slightly hard to moderately hard water. Wells in the recessional outwash yielded soft to slightly hard water. Water from the shallow wells in the Recent alluvium of the Nooksack and Sumas River flood plains differs somewhat in hardness from place to place and at various depths, in many wells the hardness being but 60 to 80 parts per million, while others ran as high as 175 parts per million with the average hardness being about 150 parts per million. Table 39 shows the hardness expressed as calcium carbonate in parts per million by weight for twenty-five wells in the report area.

Table 38. Bacteriological Water Sample Record of Municipal and Community Water Systems in the Nooksack River Report Area--1957, 1958, 1959.*

System	Number of samples submitted			Number of 10 ml portions			Number of positive portions			Percentage of portions positive			Number of samples, 3 or more tubes positive			Percentage of samples, 3 or more tubes positive		
	57	58	59	57	58	59	57	58	59	57	58	59	57	58	59	57	58	59
Acme	0	5	4	0	25	20	--	9	4	--	36.0	20.0	--	2	0	--	40.0	0
Aldergrove Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Bakerview Water Association	0	0	2	0	0	10	--	--	4	--	--	40.0	--	--	0	--	--	0
Bell-Bay-Jackson Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Blaine	8	2	3	40	10	15	4	1	5	10.0	10.0	33.3	1	0	0	12.4	0	0
Custer Water Association	1	2	1	5	10	5	0	0	0	0	0	0	0	0	0	0	0	0
Delta Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Deming	2	4	1	10	20	5	9	1	0	90.0	5.0	0	2	0	0	100.0	0	0
Everson	7	3	5	35	15	25	1	1	0	2.9	6.7	0	0	0	0	0	0	0
Ferndale	4	3	1	20	15	5	0	0	0	0	0	0	0	0	0	0	0	0
Fertile Meadows Water Association			1			5			0			0			0			0
Glacier	1	6	4	5	30	20	3	4	0	60.0	13.3	0	1	1	0	100.0	67.7	0
Gooseberry Point Water Association	0	2	1	0	10	5	--	2	0	--	20.0	0	--	0	0	--	0	0
Guide Meridian Water Ass'n.	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
"H" Street Road Water Association	1	1	1	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0
Lake Terrell Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Laurel Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Lynden	13	11	12	65	55	60	0	0	0	0	0	0	0	0	0	0	0	0
Maple Falls	5	4	4	25	20	20	15	2	1	60.0	10.0	5.0	3	0	0	60.0	0	0
Meadowdale Water Association	0	1	0	0	5	0	--	0	--	--	0	--	--	0	--	--	0	--
Mt. Baker Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Neptune Beach Water Association	1	0	1	5	0	5	1	--	0	20.0	--	0	0	--	0	0	--	0
North Star Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Northwest Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Northwood Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Old Settlers' Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Orchard Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Pleasant Valley Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Skookumchuck Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Smith Road Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Sumas	7	7	8	35	35	40	13	3	2	37.2	8.6	5.0	3	1	0	42.9	14.3	0
Sunrise Cove Water System	0	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--	--	--
Thornton Road Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Victor Water Association	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0
Whalen Utilities	0	0	1	0	0	5	--	--	0	--	--	0	--	--	0	--	--	0

* Data for this table supplied by the Whatcom County Department of Public Health.

Table 39. Chemical Analyses of Ground Waters in Nooksack River Basin.
All analyses were made by U. S. Geological Survey, except for City of Blaine and Custer Water Association, analyzed by Northwest Laboratories.

(F) : pH reading made in field during collection of sample.
(L) : pH reading made in laboratory within a few days of collection date.

Well Location	Owner or Tenant	Description of Well and Aquifer	Date of Collection
38/1E-4D1	Neptune Beach Water Assn.	143'x8"; aquifer 133'to143' in advance sands, gravels.	3/1/60
38/5E-2Q	Emma Bodtke	18' dug well; aquifer in alluvial sands, gravels.	3/2/60
38/5E-29D	Tony Fresla	16'x36"; aquifer in recessional sands, gravels.	3/2/60
39/1E-2R1	Custer Water Assn.	50'x10"; 38' blue clay, then sand and gravel aquifer.	9/30/59
39/2E-19Q	Town of Ferndale	2 wells, 157' & 160'; aquifer in advance sands, gravels.	3/1/60
39/2E-36D1	C. V. Wilder	Spring. Water-table discharge from sub-till gravels.	4/7/49
39/3E-10H1	Emma McMillan	20' dug well.	3/1/60
39/3E-18D	Meridian Water Assn.	24'x36"; aquifer in recessional sands.	3/1/60
39/4E-27E	Henry Diercks	Drilled well (only information given).	3/2/60
39/4E-32P	Otto Sehrt	179' deep; aquifer in advance sands, gravels.	3/2/60
39/4E-34C	Don Haaland	100' deep; area underlain by till, Tertiary bedrock	3/2/60
39/5E-3F1	Joe Zender	44'x6"; aquifer in recessional sands, gravels.	3/2/60
40/1E-3M1	City of Blaine	Spring. Discharge from sub-till gravels.	4/7/49
40/2E-8D	B. McPhail	Well.	3/1/60
40/2E-25A1	J. Crabtree	Well.	3/1/60
40/3E-9R1	Delta Water Assn.	2 wells: 30' & 37'; aquifer in recessional sands, gravels.	3/1/60
40/3E-15H1	Northwood Springs	Springs.	3/1/60
40/3E-28M	K. Vander Griend	375'x3"; drilled 1910 with artesian flow of 50 gpm, later plugging reduced flow to 3 gpm; salt-water aquifer probably in marine Tertiary and/or early Pleistocene sediments.	3/1/60
40/3E-36H1	City of Everson	30' dug well; aquifer is gravel in alluvium.	4/8/49
40/4E-9A	Andrew Hento	15' dug well; aquifer in recessional sands, gravels.	3/2/60
40/4E-10D1	John Brayard	84' driven well; aquifer is gravel in alluvium.	4/8/49
40/4E-33E	James Rorabaugh	Well.	3/1/60
40/5E-9Q1	Kelley's Store	102'x4"; aquifer in recessional sands, gravels.	3/2/60
41/1E-31Q1	City of Blaine	247'x12" artesian well; aquifer in advance sands, gravels.	3/2/60
41/4E-33N2	City of Sumas	Spring; aquifer is recessional sand, gravel lying on till stratum, some water from confined gravel beneath till.	3/1/60

Parts per Million															
Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved Solids at 180° C	Hardness as $CaCO_3$	Electrical Conductivity (micromhos at 25°C)	pH	Temperature °F
23	.07	31	22	20		218		14.0	.3		226	167	415	8.1(L) 7.2(F)	46
	.01	10	3.6			37					82	40	135	6.4(L) 6.2(F)	
	3.4	16	21	3.6		160		3.5	.1		162	128	255	7.4(L) 6.8(F)	
22	2.4	14.9	7.0	15.3		94.5	8.1	14.0			106	50-100		6.7(L)	
	.56	42	19	116		291		121.0			480	184	811	8.2(L) 7.0(F)	50
19	.04	23	10	18	3.0	124	8.6	22.0	.2	2.0	167	98	296	7.3(L)	
	.07	13	2.1			39					85	41	122	6.5(L) 6.1(F)	
22	.28	16	7.8	12		47	12.0	14.0	.2	32.0	132	72	218	6.9(L) 6.5(F)	
	.09	11	7.7			55			.1		86	59	133	6.8(L) 6.9(F)	
	.28	17	11			470		8.0		0	450	86	706	8.1(L) 7.6(F)	
32	.12	27	9.9	41		235		6.5		0	238	108	372	8.0(L) 7.8(F)	
	.06	26	4.6			105					118	84	188	8.2(L)	
24	.01	12	6.5	5.8	2.0	78	6.7	3.3	.2	.1	90	57	133	7.3(L)	
	.06	37	13			188		4.0			190	146	346	7.5(L) 7.0(F)	
	.23	13	3.2	3.7		44		4.0			82	46	120	6.6(L) 6.4(F)	
	.01	14	3.1			30	10.0	6.0	.1	9.8	83	48	131	6.8(L) 6.6(F)	
	.03	10	2.7			33					76	36	98	6.9(L)	42
		180	250			120		4500				1500	14,500	7.5(L)	
19	.01	28	12	21	2.2	44	12.0	84	.2	5.6	215	119	388	6.6(L)	
	4.2	7	18			120	1.4	3.0		.8		90	195	7.1(L)	
48	.42	14	17	13	2.8	138	1.6	14.0	.2	.2	175	105	245	6.8(L)	
	.54	14	19			130					152	114	290	6.7(L) 6.5(F)	
	.06	18	5.5			74					92	68	152	7.2(L) 7.0(F)	
29.6	.05	12.3	7.1	18		100.8	8.2	5.5		.01	137	60		7.9	
13	0.00	23	4.6	14		82	14.0	5.0			111	76	173	8.1(L) 7.7(F)	

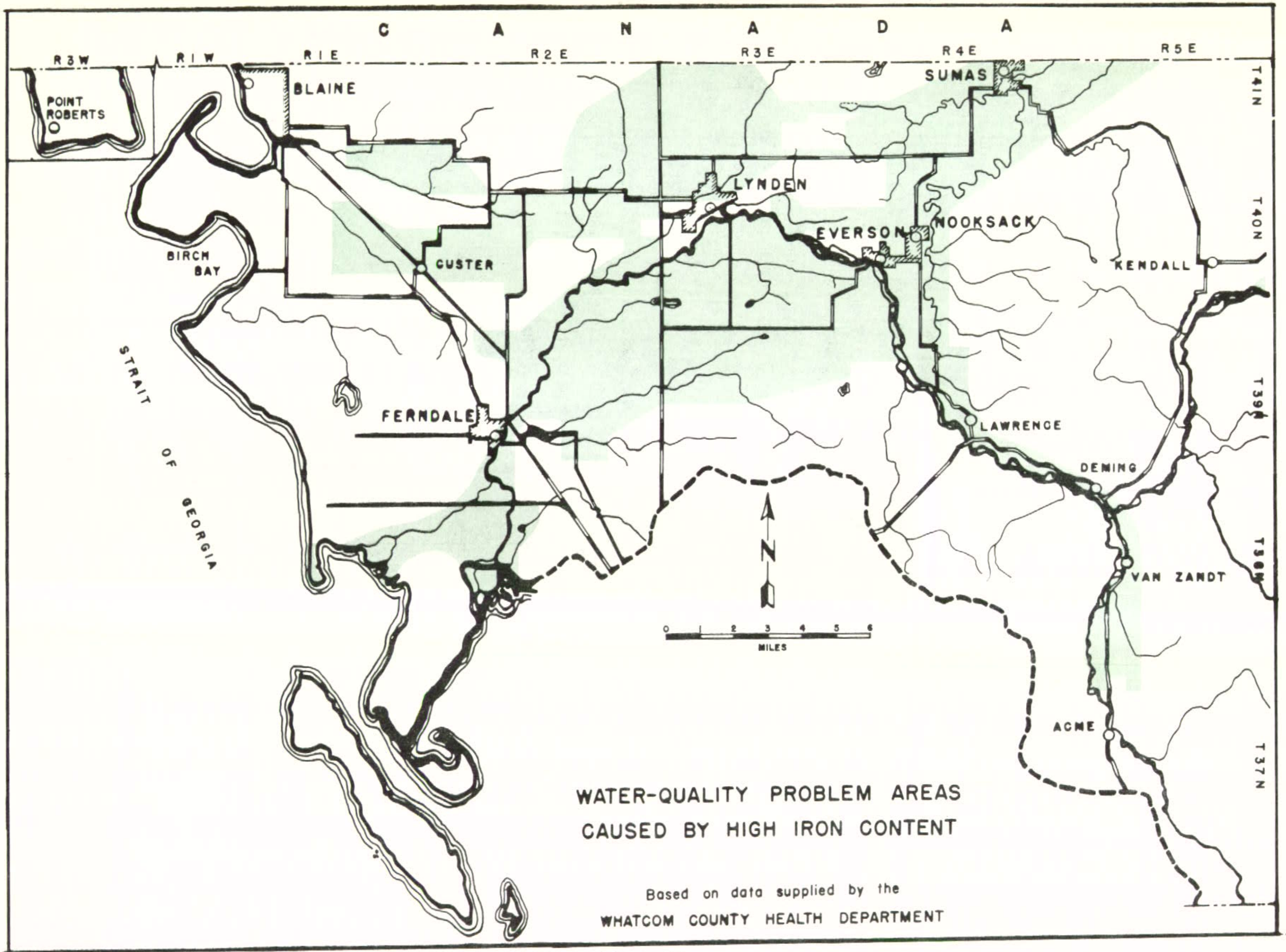
C A N A D A
R3W
R1W
R1E
R2E
R3E
R4E
R5E
T41N
T40N
T39N
T38N
T37N
POINT ROBERTS
BLAINE
BIRCH BAY
CUSTER
LYNDEN
SUMAS
EVERSON
NOOKSACK
KENDALL
FERNDALE
LAWRENCE
DEMING
VAN ZANDT
ACME
STRAIT OF GEORGIA
N
0 1 2 3 4 5 6
MILES
WATER-QUALITY PROBLEM AREAS
CAUSED BY HIGH IRON CONTENT
Based on data supplied by the
WHATCOM COUNTY HEALTH DEPARTMENT

Figure 58.

Salinity.

The small amount of ground water in the Tertiary rocks is saline or brackish, except on the mountain slopes or other places where good circulation has apparently flushed out these waters. In some places, the unconsolidated deposits overlying the Tertiary bedrock have received some saline waters from the bedrock below. The unconsolidated pre-Vashon Pleistocene deposits beneath the Mountain View and Boundary Uplands appear to contain fresh water of low chloride content even when lying as much as several hundred feet below present sea level. In deep wells that approach Tertiary bedrock or early Pleistocene marine sediments, some saline water may be encountered; other wells penetrating aquifers which are poorly supplied by fresh ground-water recharge may experience sea water encroachment if overpumped.

The principal zone of saline water lies at a depth of 100 feet or more beneath the lowlands of the Nooksack and Sumas River flood plains and the Custer Trough. Chloride content as high as 4,500 parts per million (K. VanderGriend well, 40/3-28M) has been found there. Possibly the advance and recessional outwash deposits of the Vashon glaciation were laid down in these lowlands under marine or brackish water conditions and the connate saline water has not been flushed out.

Gaseous Impurities.

Numerous wells drilled in the area where glacial materials cap the bevelled coal-bearing Tertiary rocks have struck pockets of natural gas, and in some cases water is being confined under pressure along with gas accumulation. Well 39/2-28H1 was reported to have tapped confined water that shot 100 to 150 feet into the air by gas pressure. Other wells in this area east of Ferndale produce methane gas. Well 39/4-33C1, three-quarters of a mile south of Cedarville, was reported to have had a gas explosion in the pump house when the pump was turned on. The chief constituent of the gas is methane, which was probably generated in the organic matter of the underlying Tertiary rocks. Where strata of the Tertiary rocks are bevelled, the gas may be free to move up into the overlying Pleistocene deposits, where it becomes trapped by confining clay members until encountered by wells.

A few of the wells were reported to obtain water having the odor of hydrogen sulfide gas. Such occurrence may be due to peat or swamp deposits near the aquifer.

Iron.

Iron is by far the most common objectionable constituent of ground water in the Whatcom Basin. Its occurrence is confined almost entirely to the areas of recessional outwash and Recent alluvium, the greatest concentrations being in the Recent alluvial deposits of the Sumas River flat.

Since 75 to 90 percent of the total iron present is oxidized and precipitated on contact with air, the iron is probably largely in the form of ferrous bicarbonate, $Fe(HCO_3)_2$ and likely derived from action of carbon dioxide and vegetal acids on ferric oxide and other iron compounds in the rocks, the vegetal matter possibly consisting largely of peat beds.

The chemical analysis of the iron-bearing water from well 40/4-10D1 shows the presence of manganese in a concentration of 0.42 parts per million. Manganese is often associated with iron-bearing water and may be present throughout the iron-bearing waters of this area.

Nitrate.

The Meridian Water Association's well (39/3-18D) shows a relatively high nitrate value of 32 parts per million. When nitrate is present in amounts greater than 44 parts per million, the supply is not satisfactory for public use as it can cause a circulatory disorder (metheglobinemia) in infants under six months of age.

SURFACE WATER

The chemical quality of the basin's surface water is very good and suitable for most uses, with the exception of the high iron content of the Nooksack River at Ferndale. Table 40 lists the surface water quality analyses with respective station numbers corresponding to those on plates 4 and 5.

Iron.

The presence of iron in water is often confused with hardness. Although iron does act like calcium as a hardness constituent, the iron quantity is normally so small in relation to the other hardness constituents that it can be considered insignificant.

Part of the iron in surface water is obtained from ground water discharging to streams as discussed on preceding pages; in addition, iron is a constituent of the chlorophyll of green leaves and high concentrations of iron are found in swamp waters and in low lying ponds with deficient drainage. This iron is in organic combination until worked over by bacteria during decomposition processes in many places forming deposits of bog iron. There are numerous such deposits in the basin which likely contribute much to the high iron content found at Ferndale.

Most of the information regarding iron in surface water was collected and analyzed by the General Petroleum Corporation at Ferndale. Their results show iron in quantities ranging from 0.11 to 0.8 parts per million, which is exceptionally high for a mountain-fed stream such as the Nooksack River. Only two other iron analyses have been made of surface water in the basin. They showed 0.11 parts per million in the Nooksack River at Deming and 0.03 parts per million at Northwood Springs, east of Lynden. The lack of iron analyses on the forks of the Nooksack River and lower tributaries make it impossible to accurately locate the source of the high iron concentration at Ferndale. It is assumed, however, that the majority of the iron leaches from bog iron deposits in the Lynden, Lawrence, and Van Zandt areas. The Whatcom County Health Department has found iron problems to be prevalent throughout much of the lower basin (fig. 58). Visual examinations of the streams in this area show red precipitates along the banks of lowland streams which tend to support this theory. Ground-water analyses by the U. S. Geological Survey discussed in preceding pages also indicate iron problem areas in this vicinity. In addition the one quality sample collected at Deming shows a substantially lower iron content than that at Ferndale. Thus, although there is no absolute proof that the high iron content at Ferndale originates in the lower basin, all indications seem to bear this out.

CHARACTERISTICS AND TREATMENT OF IRON

The effects and treatment of iron in water are similar regardless of whether the supply is surface or ground water. Iron is undesirable in domestic supplies since it stains plumbing fixtures, cooking utensils, and clothing when

Table 40. Surface-water Quality Analyses, Nooksack River Basin, in parts per million.

Place of Collection	Station No.	Date of Collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)
Nooksack River at Deming	NS10	9-22-47	9.4	--	13	3.7	(0.5)		37
Nooksack River at Deming	NS10	6-18-48	7.6	0.11	12	2.3	(.0)		32
Nooksack River at Lynden	NS16	6-30-47	8.2	--	12	3.2	(0.2)		37
Nooksack River at Ferndale	NS21	12-24-52	10	0.11	13	5.0	3.2	0.6	46
Nooksack River at Ferndale*	NS21	2-25-53	7.0	0.3	12	6.0	5.0	1.0	51
Nooksack River at Ferndale*	NS21	3-25-53	12	0.8	8.0	3.0	3.0	1.0	42
Nooksack River at Ferndale*	NS21	4-23-53	11	0.8	7.0	3.0	5.0	1.0	37
Nooksack River at Ferndale*	NS21	5-25-53	16	0.7	10	3.0	2.0	1.0	38
Nooksack River at Ferndale*	NS21	6-53	19	0.5	11	3.0	2.0	1.0	42
Nooksack River at Ferndale*	NS21	7-22-53	20	0.8	10	3.0	3.0	1.0	42
Nooksack River at Ferndale*	NS21	9-10-53	28	0.3	10	5.0	2.0	1.0	42
Nooksack River at Ferndale*	NS21	9-30-53	11	0.5	10	4.0	3.0	1.0	41
Nooksack River at Ferndale*	NS21	10-29-53	15	0.3	14	2.0	2.0	1.0	46
Nooksack River at Ferndale*	NS21	12-9-53	20	0.8	6.0	4.0	5.0	2.0	42
Nooksack River at Ferndale*	NS21	2-1-54	26	0.5	10	6.0	3.0	1.0	44
Nooksack River at Lawrence	2107	7-15-59	5.9	--	8.0	1.2	0.9	0.5	24
Nooksack River at Lawrence	2107	8-20-59	8.6	--	12	1.2	1.5	0.9	34
Nooksack River at Lawrence	2107	9-1-4-59	8.5	--	11	2.3	1.7	0.6	36
Nooksack River at Lawrence	2107	9-5-10-59	7.2	--	8.0	1.5	1.4	1.2	27
Nooksack River at Lawrence	2107	9-11-24-59	8.0	--	10	2.1	1.6	0.5	34
Nooksack River at Lawrence	2107	9-25-30-59	7.5	--	10	1.3	1.4	0.5	32
Nooksack River at Lawrence	2107	10-1-8-59	9.7	--	12	2.4	1.7	0.4	40
Nooksack River at Lawrence	2107	10-9-16-59	7.9	--	11	0.8	1.3	0.4	31
Nooksack River at Lawrence	2107	11-17-31-- 11-1-4-59	8.9	--	9.5	2.5	1.4	0.4	36
Nooksack River at Lawrence	2107	11-5-17-59	9.2	--	11	2.9	1.7	0.4	41
Nooksack River at Lawrence	2107	11-18-29-59	7.8	--	8.0	1.9	1.3	0.7	29
Nooksack River at Lawrence	2107	11-30, 12-1-10-59	9.8	--	11	2.1	1.6	0.3	39
Nooksack River at Lawrence	2107	12-11-14-59	8.8	--	8.5	2.5	1.5	0.5	35
Nooksack River at Lawrence	2107	12-15-17-59	8.4	--	7.0	1.7	1.2	0.6	28
Nooksack River at Lawrence	2107	12-18-31-59	9.3	--	9.5	3.1	1.5	0.4	40
Nooksack River at Lawrence	2107	1-1-13-60	10	--	12	3.4	2.0	0.5	46
North Fork at Shuksan	NS1	12-16-59	6.3				--		19
North Fork near Glacier	NS2	12-16-59	--				1.0		26
Glacier Creek at Glacier	NS3	12-16-59	--				1.9		28
Canyon Creek near Glacier	NS4	12-16-59	--				--		32
Maple Creek near Kendall	NS5	12-16-59	--				1.5		41
Middle Fork Nooksack River near VanZandt	NS7	12-16-59	--				--		21
Skookum Creek near Wickersham	NS8	12-16-59	--				--		21
South Fork Nooksack River near Saxon Bridge	NS9	12-16-59	--				--		24
Nooksack River at Deming	NS10	12-16-59	--				--		27
Nooksack River at Everson	NS12	12-16-59	--				--		29
Anderson Creek at Goshen	NS11	12-16-59	--				--		21
Nooksack River near Lynden	NS16	12-16-59	8.7				--		28
Fishtrap Creek below Lynden	NS17	12-16-59	--				3.5		24
Bertrand Creek at Willeys Road Crossing	NS18	12-16-59	--				2.6		16
Nooksack River at Ferndale	NS21	12-16-59	--				--		27
Silver Creek at Slater Road	SL1	3-2-60	--				--		93
Tenmile Creek at Guide Meridian	NS19	3-2-60	--				--		
Fourmile Creek at Guide Meridian	NS20	3-2-60	--				--		
Scott Ditch at Hannegan Road	NS15	3-2-60	--				--		
Northwood Springs	NS14	3-2-60	--	0.03	10	2.7	--		33
Harvey Creek at Blaine-Sumas Road	NS13	3-2-60							
Kendall Creek at Kendall Highway	NS6	3-2-60							
Terrell Creek at Kickerville Road	TR1	3-2-60							
California Creek at Birch Bay Lynden Road	CL1	3-2-60							33
South Fork Dakota Creek at Custer School Road	DK2	3-2-60							
North Fork Dakota Creek at Custer School Road	DK1	3-2-60							25
Sumas River at Rock Road	SM1	3-2-60					11		116
Saar Creek at Rock Road	SM4	3-2-60							
Johnson Creek at Main St., Sumas	SM3	3-2-60					4.6		61
Pangborn Creek at Clearbrook Road	SM2	3-2-60							

* Analyses by Mobil Oil Company Laboratories Department

Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids: Parts per million	Dissolved Solids: Tons per acre-foot	Dissolved Solids: Tons per day	Hardness as $CaCO_3$: Calcium, magnesium	Color	Specific conductance (micromhos at 25°C)	pH
0	16	1.0	--	0.3	--	62	0.08	214	48	--	100	--
0	11	0.5	0.3	0.4	--	46	0.06	671	40	--	67	7.6
0	11	0.9	--	0.3	--	54	0.07	493	43	--	79	--
0	16	3.8	0.1	--	0.04	80	0.11	160	--	--	121	7.4
0	14	5.0	0.1	--	0.1	87	0.12	441	56	--	119	7.4
0	9.0	3.0	0.1	--	0.1	62	0.08	720	33	--	79	7.0
0	17	3.0	0.1	--	0.1	76	0.10	1315	33	--	66	8.1
0	17	3.0	0.1	--	0.1	84	0.11	725	38	--	79	7.5
0	15	2.0	0.1	--	0.1	85	0.12	990	39	--	82	7.3
0	13	5.0	0.1	--	0.1	80	0.11	670	38	--	100	7.4
0	23	2.0	0.1	--	0.1	100	0.14	364	48	--	138	8.1
0	24	3.0	0.1	--	0.1	70	0.10	1340	45	--	92	7.7
0	15	6.0	0.2	--	0.1	73	0.10	831	45	--	82	7.8
0	21	6.0	0.5	--	0.1	87	0.12	2940	33	--	77	7.3
0	20	5.0	0.1	--	0.2	94	0.13	761	51	--	94	7.4
0	6.9	0.2	0.2	0.1	--	38	0.05	420	25	15	58	7.0
0	13	0.8	0.2	0.1	--	51	0.07	233	35	5	86	7.3
0	13	.0	0.2	0.3	--	55	0.07	313	37	10	89	7.3
0	6.3	0.5	0.3	0.4	--	43	0.06	843	26	20	61	7.0
0	9.3	0.8	0.2	0.3	--	53	0.07	395	34	20	81	7.3
0	7.0	0.5	0.2	0.4	--	49	0.07	749	30	25	71	7.3
0	11	.0	0.1	.0	--	61	0.08	338	40	5	93	7.7
0	7.7	0.5	0.1	0.2	--	52	0.07	685	31	20	72	7.3
0	8.8	0.5	0.1	0.2	--	55	0.07	659	34	15	81	7.4
0	9.5	0.8	0.1	0.2	--	60	0.08	398	40	5	93	7.4
0	5.7	0.5	0.1	0.4	--	50	0.07	859	28	20	66	7.3
0	8.3	0.8	0.1	0.6	--	52	0.07	469	36	5	90	7.3
0	7.1	0.5	0.1	0.5	--	50	0.07	719	31	20	78	7.3
0	5.4	0.2	0.1	0.8	--	46	0.06	1748	24	35	61	7.7
0	7.1	0.8	0.1	0.7	--	53	0.07	566	36	5	85	7.8
0	9.1	1.0	0.1	0.7	--	61	0.08	308	38	5	105	7.7
		--	--	0.4					16		40	7.5
		--	0.5	--					29		69	7.5
		.0	--	--					27		68	7.4
		--	--	--					27		64	7.4
		--	0.1	1.7					41		93	7.4
		--	--	0.3					--		48	7.3
		--	--	--					--		42	7.2
		--	--	--					21		48	7.4
		--	--	--					25		61	7.2
		--	--	--					--		61	7.3
		1.0	--	1.8					18		54	6.8
		.0	--	0.8					--		63	7.2
		--	0.5	3.8					43		116	6.6
		--	--	3.2					24		71	6.6
		--	0.1	1.0					27		65	7.0
0		22							90		267	7.2
		11							84		231	7.0
									62		176	6.9
		27		3.6							253	6.7
0						76			36		98	6.9
			0.1						50		133	7.2
									70		157	7.7
		5.0	0.1						23		75	6.8
0									74		281	6.7
		24	0.2						51		207	7.8
0		10							24		96	6.9
0		15							102		217	7.6
											101	7.1
0		5.2							62		150	7.1
		3.8							46		119	7.1

Table 41. Processes of Iron and Manganese Removal.*

Treatment or Processes	Oxidation Required	Character of Water	Equipment Required	pH Range Required	Chemicals Required	Remarks
Aeration Sedimentation Sand filtration	Yes	Iron alone in absence of appreciable concentrations of organic matter	Aeration, settling basin, sand filter	Over 6.5	None	Easily operated. No chemical control required.
Aeration, contact oxidat'on, sedimentation, sand filtration	Yes	Iron and manganese loosely bound to organic matter, but no excessive carbon dioxide or organic acid content	Contact aerator of coke, gravel, or crushed pyrolusite, settling basin, and sand filter	Over 6.5	None	Double pumping required. Easily controlled.
Aeration, contact filtration	Yes	Iron and manganese bound to organic matter, but no excessive organic acid content	Aerator and filter bed of manganese coated sand, "Birm," crushed pyrolusite ore, or manganese zeolite	Over 6.5±	None	Double pumping required unless air compressor, or "sniffler valve" is used to force air into water. Limited air supply adequate. Easily controlled.
Contact filtration	Yes, but not by aeration	Iron and manganese bound to organic matter, but no excessive carbon dioxide or organic acid content	Filter fed of manganese coated sand, "Birm," crushed pyrolusite ore, or manganese zeolite	Over 6.5	Filter bed reactivated or oxidized at intervals with chlorine or sodium permanganate	Single pumping. Aeration not required.
Aeration, chlorination, sedimentation, sand filtration	Yes	Iron and manganese loosely bound to organic matter	Aerator and chlorinator or chlorinator alone, settling basin and sand filter	7.0 to 8.0	Chlorine	Required chlorine dose reduced by previous aeration but chlorination alone permits single pumping.
Aeration, lime treatment, sedimentation, sand filtration	Yes	Iron and manganese in combination with organic matter, and organic acids	Effective aerator, lime feeder mixing basin, settling basin, sand filter	8.5 to 9.6	Lime	pH control required.
Aeration, coagulation and lime treatment, sedimentation, sand filtration	Yes	Colored, turbid, surface water containing iron and manganese combined with organic matter	Conventional rapid sand filtration plant	8.5 to 9.6	Lime and ferric chloride or ferric sulfate, or chlorinated copperas, or lime and copperas	Complete laboratory control required
Zeolite softening	No	Well water devoid of oxygen, and containing less than about 1.5 to 2.0 ppm iron and manganese	Conventional sodium zeolite unit, with manganese zeolite unit or equivalent for treatment of bypassed water	Over 6.5±	None added continuously but bed is regenerated at intervals with salt solution	Only soluble ferrous and manganous compounds can be removed by base exchange, so aeration or double pumping is not required.
Lime treatment, sedimentation, sand filtration	No	Soft well water devoid of oxygen containing iron as ferrous bicarbonate	Lime feeder, enclosed mixing and settling tanks and pressure filter	8.0 to 8.5	Lime	Precipitation of iron in absence of oxygen occurs at lower pH than otherwise. Absence of oxygen minimizes or prevents corrosion. Double pumping not required.

* Cox, C. R. 1952, Water supply control: New York State Dept. of Health, Bull. 22, p. 159-160.

Table 42. Sanitary analysis of Nooksack River at Lawrence Quality Station.

Collection		Temperature °C.	Coliform Organisms MPN*	Dissolved Oxygen	
Date	Time			ppm	Saturation
7-15-59	0800	11.5	91	10.7	96.0%
8-20-59	0630	12.0	230	9.8	90.5%
9-29-59	0715	9.0	36	10.9	94.0%
10-21-59	0710	9.8	23	11.6	101.9%
11-19-59	0700	5.0	91	11.6	90.6%
12-22-59	0720	3.2	230	12.2	91.0%
1-20-60	1810	2.0	150	13.4	96.8%
2-17-60	0700	3.2	230	12.5	93.2%

* Most probable number of coliform organisms per 100 milliliters of the sample analyzed.

present in concentrations of about 0.3 parts per million or greater. It is also undesirable in industries such as paper manufacturing where clear water is essential for a quality product (tab. 36).

Iron may also cause tastes and odor through the growth of iron-forming bacteria such as Crenothrix and Leptothrix. These bacteria grow in pipes carrying water devoid of oxygen and with as little as 0.1 parts per million of iron in solution. These organisms secrete iron and deposit ferric hydroxide as well as oxidizing ferrous to ferric iron which precipitates ferric hydrate which causes the discoloration and staining. Small gray or brownish flakes or masses of stringy or fluffy growths in water indicate the presence of iron bacteria. Additional iron problems can be caused by corrosive waters which attack iron pipe and house plumbing resulting in red water problems.

Treatment for removal of iron is necessary for many ground-water supplies in the basin as well as some surface waters. The commonly used methods for removal of iron from water are outlined in table 41.

Iron-forming bacteria can present an additional treatment problem which is most effectively handled through complete iron removal and chlorination to kill the bacteria and clear up the system.

PHYSICAL

The physical characteristics of water are those generally noticed by the casual observer. Temperature, color, turbidity, taste, and odor are usually determined in a standard physical analysis.

COLOR

The only physical test conducted in the basin was the color test, and the results of this analysis are listed in table 40. Color in untreated water usually comes from organic compounds in suspension leached from decaying or decomposed vegetation. A colored turbidity, such as caused by red clay, is sometimes described as apparent color. The samples taken from the Nooksack River ranged from 5 to 35 parts per million and comparison of these results with the standard in table 37 indicates that color removal is necessary for municipal water use.

Coagulation, settling and rapid sand filtration reduces the color in water to less than 5 parts per million, while slow sand filters should remove about 40 percent of the color.

SANITARY

A sanitary analysis determines the water characteristics which are of sanitary or pollution significance. This analysis is usually made in connection with a sanitary survey to explain the significance of the analysis and to locate pollution sources, unless the test is being made only to gather background information, as is presently the case in the lower Nooksack River basin. This analysis includes tests for the number of coliform organisms present, dissolved oxygen, biochemical oxygen demand, oxygen consumed from chromic acid, nitrogen in its various forms, and total organic constituents. Usually the total and suspended solids are also determined in a sanitary analysis. Although all the above tests are important, only the bacteria and dissolved oxygen content have been determined in the Nooksack River basin. These samples were all collected by the Pollution Control Commission at the permanent quality station located near Lawrence, and are tabulated in table 42. These sample results indicate that the water is quite free of pollution as evidenced by the low concentration of coliform organisms present and the high percentage of dissolved oxygen.

BIOLOGICAL

No biological tests have been conducted in the study area for no special problems have occurred to warrant such tests.

POLLUTION AND DEGRADATION

Water quality deteriorates through the influence of irrigation return water as well as contamination and pollution by industrial wastes, sanitary sewage, and refuse. Although the Division of Water Resources has certain responsibilities

Table 43. Industrial Waste Facilities in the Nooksack Report Area Based on Data Supplied By Washington State Pollution Control Commission.

Company	Location	Type of Wastes	Average Daily Flow Gallons	Maximum Daily Flow Gallons	Treatment	Waste Recipient	Permit Issued	
							From	To
Alaska Packers Association	Blaine	Fish by-products and cooling		283,000	Solids collection, screened and submerged outfall	Boundary Bay	7-26-57	7-26-62
Blaine Fish Products Co.	Blaine	Miscellaneous and cooling		50,000	Grease traps	Semiahmoo Bay	8-6-56	8-6-61
Carnation Company	Ferndale	Milk products	90,000	150,000	Septic tank	Nooksack River	8-24-55	8-24-60
DeJong Packing Company	Lynden	Slaughtering	1,600	1,600	Good housekeeping, grease trap, septic tank, drainfield, gravel bed	Fishtrap Creek	5-25-56	5-25-61
Farmers Meat Company	Sumas	Meat Packing		2,000	Good housekeeping, grease trap, septic tank, drainfield,	Sumas River	6-26-56	6-26-61
General Petroleum	Ferndale	Petroleum		1,000,000	Distillation and stripping, emulsion breaking, neutralization, chemical oxidation, filtration, septic tank for sanitary	Georgia Strait	7-25-55	7-25-60
Iverson Canning Company	Point Roberts	Fish canning				Puget Sound		
C.S. Kale Canning Company	Everson	Canning and cooling			Screen and lagoons, none for cooling	Nooksack River	12-30-55	12-30-60
Kelley, Farquhar and Company	Ferndale	Canning and cooling	348,000	1,000,000	Screened, city sewers	Nooksack River	6-28-57	6-28-62
Kratzig Meat Company	Laurel	Slaughtering	800	1,200	Good housekeeping, septic tank, drainfield	Subsurface to Tenmile Creek	11-28-55	11-28-60
Lynden Berry Growers Ass'n.	Lynden	Canning and cooling		40,000	Screened, city sewer	Nooksack River	7-12-57	7-12-62
Lynden Dairy Products Co.	Lynden	Milk products	100,000	200,000	Good housekeeping	Nooksack River	4-23-56	4-23-61
Lynden Frozen Foods, Inc.	Lynden	Canning and cooling		180,000	Screened and city sewer (storm)	Stickney Slough	6-28-57	6-28-62
Minute Maid Corp.	Lynden	Canning and cooling		20,000	Screened and city sewer	Nooksack River	1-26-56	1-26-61
Nelbra Packing Company	Point Roberts	Fish canning				Puget Sound		
Point Roberts Fisheries	Point Roberts	Fish canning				Puget Sound		
Sumas Dairy Products Co.	Sumas	Milk products		15,000	Septic tanks	Sumas River	5-14-56	5-14-61
Western Condensing Company	Lynden	Milk products and cooling		150,000	Good housekeeping	Nooksack River and cooling Fishtrap Cr.	6-7-56	6-7-61
Whatcom Builders Supply Company	Ferndale	Sand and gravel	8,000	140,000	Lagoon, 2 day retention	Tributary of Nooksack River	6-8-56	6-8-61
Whatcom Builders Supply Company	Lynden	Sand and gravel	24,000	100,000	Lagoon, seepage to river	Nooksack River	8-12-57	8-12-62
Whatcom County Dairymens' Ass'n.	Lynden	Milk products and cooling	180,000	340,000	Good housekeeping	Nooksack River and cooling Fishtrap Cr.	6-4-56	6-4-61
Whiz Fish Products Company	Blaine	Fish by-products		4,000	Solids collection, screened outfall	Drayton Harbor	5-21-56	5-21-61

Table 44. Municipal Waste Facilities in the Nooksack Report Area Based on Data Supplied by the Washington State Department of Health.

City or Sewer District	Type of Sewer System	Average Daily Flow Gallons	Treatment Facilities: Designed For: Population Equivalent	Treatment Facilities: Designed For: Average Daily Flow Gallons	Treatment Facilities: Type	Waste Recipient	Population Served
Blaine	Separate				None	Drayton Harbor	1,000
Everson	Separate				Individual septic tanks, effluent collected by municipal sewers.	Nooksack & Sumas Rivers	300
Ferndale	Separate		800		28,500 gallon septic tank, gas chlorination with contact tank, open sludge beds.	Nooksack River	1,000
Lynden	Separate	250,000	2,000	450,000	Screened (bar rack), mechanical settling tanks, rotary distributor trickling filter, gas chlorination, covered digester, open sludge beds.	Nooksack River	2,000
Sumas	Combined				Private septic tanks, effluent collected by municipal sewers.	Sumas River	500
Whatcom County Hospital	Separate		300	30,000	Screened, Imhoff Tank, rotary distributor trickling filter, settling tank, gas chlorination and open sludge beds.	Silver Creek.	300

for protecting the quality of Washington's waters, that phase of water resource administration is generally under the authority of the Washington State Department of Health and the Pollution Control Commission. The State Department of Health has authority outlined in their rules and regulations to prohibit pollution affecting domestic water supplies or which otherwise endangers the health and well-being of the people.

Under the state's pollution control program, plans and specifications of waste disposal facilites are processed by the Pollution Control Commission working in cooperation with the State Department of Health. By working with industries prior to the actual beginning of construction, these agencies are able to recommend necessary alterations and modifications and, thus, avoid excessive future expense for changing waste treatment facilities.

Since inauguration of the pollution permit system in 1955, nineteen industries have been licensed in the study area, all in the Whatcom Basin. Those industries are tabulated in table 43, together with existing industries not as yet covered under the permit program. This information was obtained from the files of the Pollution Control Commission.

Municipal, community, and institutional sewerage systems are listed in table 44. Information for those systems, which are not covered under a permit system, was submitted by the State Department of Health, who assists cities in developing sewerage systems.

The two tables cited above include only the major known sources of man-made pollution in the study area. There exists, of course, considerable natural and animal pollution, particularly on smaller streams of the watersheds.

WATER USE

There was an upsurge of water utilization and development throughout western Washington during World War II and the following years. This was primarily due to the increases in water demands for manufacturing, municipal use, power, and irrigation. The increased water use and demand has also been sharply felt in the Nooksack River basin with current and anticipated conflict of interest emphasized on the smaller streams. The greatest increase within the study area, however, was for irrigation purposes.

WATER RIGHTS AND WATER LAW

Since the water use discussion which follows is based primarily on the water right records of the Division of Water Resources, it is only proper to first present a brief description of the evolution of our Washington State Water Code and the manner in which water rights are established.

Under Article XXI of our State Constitution, it is provided that water for irrigation, mining, and manufacturing, shall be deemed a public use. The procedure for appropriating these public waters was provided soon thereafter under Chapter CXLII, Session Laws of 1891. Under this statute, rights to the use of the surface waters of the state could be acquired by posting a notice in writing at a conspicuous place at the point of intended diversion, and filing a copy of the notice with the county auditor of the county in which the notice was posted. Through compliance with the specific provisions of this act and the development and use of the waters in question, rights were established with a date of priority which related to the date of the posting of the notice. However, this procedure proved to be inadequate since no supervisory agency had been created to assure compliance with the provisions of the act. Therefore, numerous filings were made whereby the notice was posted at the intended point of diversion and a copy was filed with the local auditor but no actual diversion was made. Thus, the appropriation was never consummated and the actual right never established. However, due to the lack of records, it was not known, without considerable investigation and litigation, as to which filings had actually been perfected.

Through the years many conflicts arose over rights to the use of public waters and in about 1913 the governor was petitioned to compile a water code for the state. As a result, a commission was formed which drafted a code of some 44 sections which was passed into law by the legislature as Chapter 117, Laws of 1917.

Chapter 117, Laws of 1917, became effective June 6, 1917, and has become known as the Surface Water Code. This code extended the concept of rights by appropriation by declaring that subject to existing rights, all waters within the state belong to the public and any right thereto, or to the use thereof, could only be acquired by appropriation for a beneficial use as provided in the act. Although the code provided that as between appropriations the first in time shall be the first in right, it further declared that nothing in the act shall lessen, enlarge, or modify the rights of riparian owners existing as of June 6, 1917, or any right however acquired, existing as of that date. The act created the office of Hydraulic Engineer to administer these laws and the basic concept of the laws has not been changed through the 43 years of their existence. However, the office of the Hydraulic Engineer has, by law, become a division of the Department of Conservation and the duties of administration now fall upon the Supervisor, Division of Water Resources, of that department.

Since the code recognized rights which existed at the time it became effective, a procedure was established whereby the extent and priority of said rights could be determined. This procedure involves the adjudication of all rights on a certain stream or water course through a hearing in the superior court of the county in which the majorpart of the stream is located. Normally, the supervisor of the Division of Water Resources acts as referee, conducting the hearing and taking evidence for the court. Upon conclusion of the hearing a report is prepared by the referee whereby a schedule of rights is presented, setting forth the priority and extent of the rights of each claimant. If adopted by the court, this report then becomes a decree in the case and title to all rights on the stream are determined. It should be noted that this action is only required to establish the validity and extent of rights claimed by use prior to 1917.

Where an appropriation is to be initiated after June 6, 1917, the code provides that application must be made to the supervisor for a permit to make the appropriation and that no use or diversion of water shall be made until a permit has been issued. Applications to appropriate public waters must be submitted on forms supplied by the supervisor. When received in the office of the supervisor, the date and time of receipt is endorsed thereon and this date establishes the priority of the application. After office review of the application, a notice for publication is prepared and forwarded to the applicant together with instructions for publication. It is a statutory requirement that this notice appear once a week for two consecutive weeks in a newspaper of general circulation published in the county, or counties, in which the storage or diversion is to be made. A period of thirty days from last date of publication is then provided as a protest period during which formal objections to the approval of the application may be recorded. At this time, notice of the application is also forwarded to the State Department of Fisheries and the State Department of Game and no formal action on the application is taken until such time as the recommendations of those departments are received. Following due notice to the public, a field investigation is conducted by a representative of the Division of Water Resources to determine what water, if any, is available for appropriation and to determine to what beneficial use or uses it can be applied. After full review of the application, written findings of fact are prepared concerning all aspects of the application. If it is found that there is water available for appropriation in the proposed source of supply, and that the proposed use will not conflict with existing rights, or, threaten to prove detrimental to the public interest having due regard to the highest feasible development of the use of the waters belonging to the public, the application may be approved.

Approval of the application and issuance of permit constitutes authority for the commencement of actual construction work which will lead to use of the waters in question. For small projects it is normally specified that construction shall be started within one year from the date of issuance of permit, shall be completed in the second year, and full beneficial use of the waters shall be made in the third year. If in good faith, this schedule cannot be met, extensions of time are granted upon request. This permit may be considered as an agreement between the permittee and the supervisor for the development and use of the waters in accordance with the terms of the permit. Once the water has been put to beneficial use, the permittee may acquire the final certificate of water right. However, since it is a fundamental concept of our water laws that an appropriation does not extend in a legal sense to any water except as it is used beneficially, the final certificate of water right issues only for that quantity of water actually used and for the purposes to which the water has been beneficially applied within the maximum limits set by the permit. Should a permittee fail to comply with the conditions of the permit, he is notified by registered mail that he has sixty days in which to show cause why his permit should not be cancelled. If the permittee does not show cause, the permit is cancelled without further notice.

With issuance of the final certificate of water right, processing of the application and permit is completed. Through the certificate, title to the waters in question is acquired and the actual water right is perfected. The right acquired by this appropriation becomes an appurtenance to the property described therein as the place of use with the date of priority relating to the original date of filing of the application in the office of the supervisor. Since no provision exists in the present surface water code for the revoking of such certificates, perpetual rights are established.

Whenever storage of water is contemplated, either within the stream channel or adjacent thereto, a storage permit may be required. Normally such a permit is to be obtained whenever the dam or dike will store water to a depth of ten feet or more at its deepest point, or ten acre-feet or more of water will be retained. Furthermore, the surface-water code provides that whenever it is proposed to construct any dam or controlling works for the storage of ten acre-feet or more of water, detail plans and specifications of the structure must be submitted to the supervisor for his examination and approval as to safety before construction is started. The supervisor requires that such plans and specifications be prepared by a properly qualified registered professional engineer and carry his signature and seal. Applications for reservoir permit must be made on forms supplied by the supervisor and the procedure for processing of such applications is the same as described under applications for appropriation permit.

Since development and use of public ground waters of the state took place at a slower rate than the surface waters, the need for regulatory control evolved at a later date. However, with improvement of drilling techniques and the expansion of the industrial, municipal and irrigation requirements of the state, the need for laws relating to the appropriation and use of ground water became evident. Therefore, in 1945 the Association of Washington Cities sponsored and assisted in drafting legislation which is now referred to as the Washington State Ground-Water Code.

The laws relating to ground water supplement the surface-water code of the state and were enacted for the purpose of extending the application of the surface-water statutes to the appropriation of ground waters for beneficial use. Thus, the laws are administered by the Division of Water Resources and the appropriation procedure is essentially the same. Basically, the law provides that no withdrawal of public ground waters shall be begun, nor shall any well or works for such withdrawal be constructed unless an application to appropriate such waters has been made to the supervisor and a permit has been granted by him. However, it is further provided that for any withdrawal of public ground waters for stock water purposes, or for watering of a lawn, or of a non-commercial garden not exceeding one-half acre in area, or for single or group domestic uses, or for an industrial purpose, and in an amount not exceeding 5,000 gallons per day, a permit is not required from the supervisor. Applications may be submitted for these purposes if any person or agency wishes to record the well and the use made thereof.

In much the same manner as the surface-water code of 1917, the ground-water code recognizes existing rights established by development and use of ground waters prior to the effective date of the code, June 6, 1945. However, the ground-water code differed in that a declaratory period was provided whereby wells developed prior to 1945 could be recorded. The code provided that any person claiming a vested right for the withdrawal of public ground waters by virtue of prior beneficial use, could within three years after June 6, 1945, receive from the supervisor a certificate of ground-water right to that effect, upon declaration by the claimant in a form prescribed by the supervisor. This declaratory period was subsequently extended for a period of two years such that a total of five years was allowed in which a certificate could be acquired under declarations of claim.

In the review of all records concerning water rights established in the Nooksack River basin, the miscellaneous water right records of the Whatcom County Auditor's office were consulted. It was found that approximately 219 filings had been recorded in that office during the 21-year period from 1897 to 1917. The majority of these filings were in the form provided by the Laws of 1891, whereby notices of appropriation were to be posted at the intended point of diversion. Since these records do not disclose as to whether the appropriation was actually consummated, a field check was made during the summer of 1960 to determine if diversions and use were being made of the water at that time. Supporting evidence which indicated that development had taken place and that water had actually been used was found in less than 5 percent of the recordings. However, adjudication proceedings would be required to establish the extent and validity of any claim to rights under the recordings in the Whatcom County Auditor's office.

It is probable that many instances occur in the basin where diversions were initiated prior to June 6, 1917, and no recording was made with the local county auditor. However, since the 1917 act recognized all existing rights, the courts have subsequently held that if water was diverted and applied to a beneficial use prior to 1917, and the use has been continuous through the years, the use has ripened into a valid right regardless if a recording was made with the auditor. Again, adjudication proceedings would be required to quiet title to such claim to vested rights.

In the consideration of all vested rights, continuity of use is important. If it is found through adjudication proceedings or quiet title action that a long period of non-use has taken place, the courts may rule that the right has been abandoned. However, our laws do not provide for a statutory period which constitutes abandonment and each instance of non-use must therefore be considered individually.

Table 45. Surface-water Use By Drainage Basin.

Drainage Basin	Total Number of Valid Filings	Number of Irrigation Filings	Irrigation Acreage	Irrigation Quantity (cfs)	Public & Domestic Quantity (cfs)	Other Consumptive Quantity (cfs)	Non-consumptive Quantity (cfs)	Total Appropriated Quantity (cfs)
Main Nooksack River*	25	23	946.5	9.415	5.01	5.00	0	19.425
Tenmile Creek	45	43	1,064.0	12.605	0.065	0.04	0.69	13.40
Unnamed Tributary of Nooksack River	1	1	70.0	0.67	0	0	0	0.67
Wiser Lake Creek	12	12	528.0	4.03	0.02	0	0	4.05
Schneider Ditch	8	8	371.0	2.91	0	0	0	2.91
Bertrand Creek	16	16	645.0	6.51	0.03	0	0	6.54
Fishtrap Creek*	14	12	427.0	4.32	0	6.55	0	10.87
Scott Ditch	13	13	617.5	6.08	0	0	0	6.08
Stickney Slough	10	9	206.0	2.00	0.01	0.03	0	2.04
Anderson Creek	8	4	106.1	1.061	0.08	1.10	0	2.241
Smith Creek	5	5	63.0	0.48	0.02	0	0	0.50
South Fork Nooksack River	13	7	215.0	1.99	50.07	0	2.75	54.81
Middle Fork Nooksack River	2	0	0	0	250.0	0.10	0	250.10
North Fork Nooksack River	22	3	105.5	1.06	1.75	0	8.02	10.83
Willey Lake	3	3	160.0	1.29	0.01	0	0	1.30
Unnamed Slough	2	2	110.0	1.10	0	0	0	1.10
Lake Fazon	4	4	130.0	1.23	0.01	0	0	1.24
Unnamed Brook	2	2	75.0	0.77	0.01	0	0	0.78
Germans Creek	2	1	26.0	0.26	0.025	0	0	0.285
Dakota Creek	12	11	245.0	2.57	0.04	0	0	2.61
California Creek	9	7	197.0	1.47	0.01	0	0	1.48
Unnamed to Salt Water	6	3	88.0	0.80	0.04	0.02	0.30	1.16
Terrell Creek	5	3	100.0	1.00	0	0	0	1.00
Lummi (Red) River	5	5	335.0	3.35	0	0	0	3.35
Silver Creek	19	12	307.0	2.82	0.155	0.046	0.005	3.026
Lummi Island	7	1	200.0	2.00	1.145	0.005	0.21	3.36
Sumas River	19	19	583.5	5.69	0	0	0	5.69
Saar Creek	2	0	0	0	0.03	0.97	0.52	1.52
Sumas Drainage Ditch	1	1	29.0	0.29	0	0	0	0.29
Johnson Creek	22	20	683.0	6.65	3.13	0	0	9.78
Kinney Creek	1	1	25.0	0.25	0	0	0	0.25
Breckenridge Creek	3	3	95.0	0.55	0	0	0	0.55
Swift Creek	1	1	40.0	0.40	0.01	0	0	0.41
Goodwin Creek	4	4	140.5	1.19	0.01	0	0	1.20
Judson Lake	3	3	150.0	1.50	0	0	0	1.50
Total*	325	261	9,067.6	88.311	311.68	13.861	12.495	426.347

*Duplication - therefore sum does not equal total

WATER APPROPRIATION

Compilation of records of the Division of Water Resources reveals that 733 active filings exist in the basin in the form of applications, permits, and certificates. Of this total, 325 surface-water filings are recorded for a total appropriation of 426.347 cubic feet per second and 448 ground-water filings exist for a total appropriation of 77,767 gallons per minute or, 172.82 cubic feet per second. Total quantities appropriated from surface-water sources from the various sub-basins in the area are tabulated by use in table 45. Also, the comparative amounts of surface water authorized for various uses in the basin is descriptively shown in figure 59.

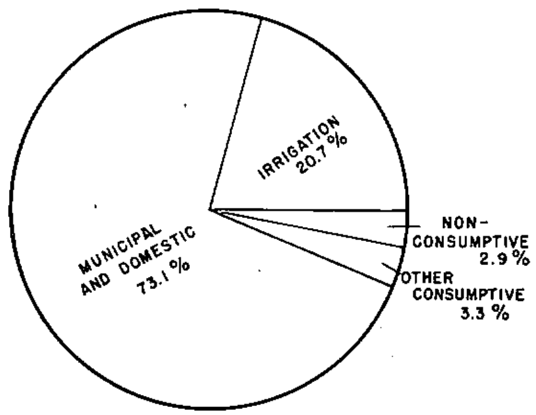

Figure 59. AUTHORIZED SURFACE WATER USE IN STUDY AREA. 426.347 cfs = 100%

Since the city Bellingham's authorized 300 second foot diversion has not been initiated to date, a more accurate portrayal of the present surface-water use is indicated by figure 60.

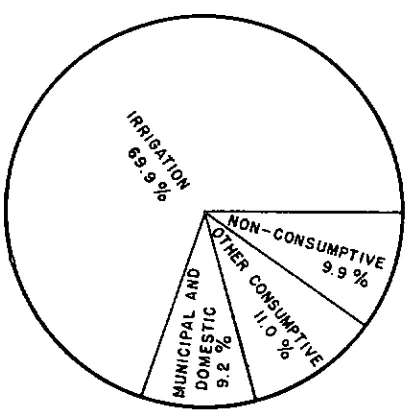

Figure 60. ACTUAL SURFACE WATER USE IN STUDY AREA. 126.347 cfs = 100%

Figures 61 and 62 show the actual charge against the Nooksack River and its tributaries above Lynden based on authorized water rights. Figure 61 is based on an average low flow of 955.26 cubic feet per second at the Lynden gage and shows the proportions of this low flow which have been appropriated. The figures take actual tributary flows into consideration; for example, the city of Bellingham could not utilize the full extent of its 250 cubic feet per second permit on the Middle Fork during low flows periods since this quantity would not be available.

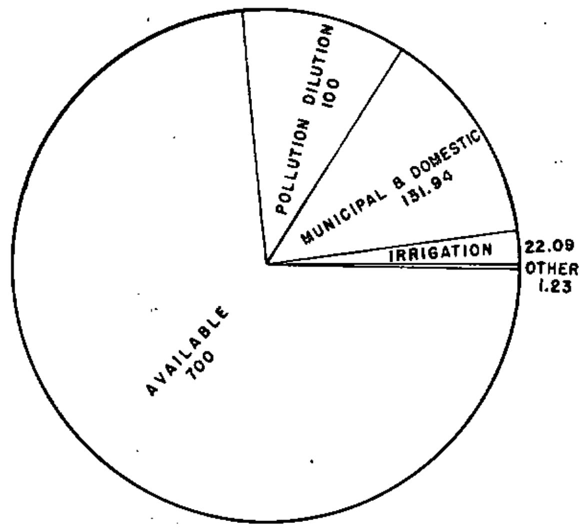

Figure 61. CURRENT WATER DEMANDS AND POTENTIAL AVAILABLE SUPPLY ON NOOKSACK RIVER, BASED ON MEAN LOW FLOW IN CUBIC FEET PER SECOND AT LYNDEN.

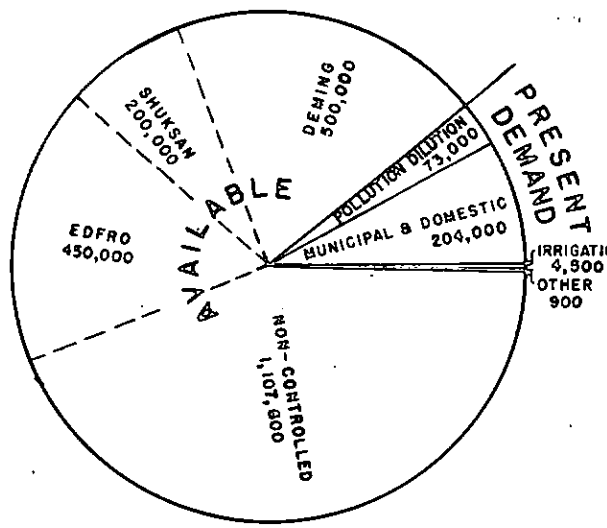

Figure 62. PRESENT DEMAND AND POTENTIAL STORAGE AT MAJOR RESERVOIR SITES STUDIED, BASED ON MEAN ANNUAL RUN-OFF IN ACRE-FEET AT LYNDEN.

Table 46. Community and Municipal Water Systems, Nooksack River Report Area, Based on Data Supplied by the State of Washington Department of Health and Whatcom County Health Department.

City or Water District	1959 Population	Connected Population*	Year Operation Started: Present Supply	Year Operation Started: Present Treatment Plant	Ownership	No. of Services	No. of meters	Sources of Supply
Acme	200	280	1945	--	Municipal	55	0	Jones Creek
Birch Bay	--	2,400			Private	500	500	Blaine
Blaine	1,800	2,000	1929	1910	Municipal	670	670	6 artesian wells, 1 drilled well
Custer	350	300	1956	--	Municipal	80	80	2 wells
Delta Water Association	--	310	1954	--	Municipal	102	102	Dug well
Deming	132	132	1906		Private	55	0	Springs
Everson	420	1,000	1936		Municipal	311	0	2 wells
Ferndale	1,405	1,500	1955	--	Municipal	700	600	5 wells
Glacier	100	100		--	Private	35	0	Gallup Creek and 1 spring
Lynden	2,501	2,927	1910	1951	Municipal	1,144	1,050	Nooksack River
Meadowdale Water Association	--	150	1958		Municipal	52	42	1 well
Meridian Water Association	--	100	1954		Municipal	31	31	Dug well
Mt. Baker Water Association	--	175	1955	--	Municipal	46	46	1 well
Neptune Beach Water Association	--	100			Municipal	33	33	2 drilled wells
Nooksack	325	350	1955		Municipal	118	116	City of Sumas
Northwest Water Association	--	275	1956		Municipal	70	70	2 wells
Old Settlers Water Association	--	140	1956		Municipal	42	42	2 drilled wells
Point Roberts	--	550	1937		Private	170	0	2 springs, 1 well
Skookumchuck Water Association	--	210	1954		Municipal	74	74	Dug well
Sumas	628	1,270	--	--	Municipal	442	303	Springs

*Estimated population served by city or water district

Safe Yield Surface Supply Sub-surface Supply GPD	Treatment Plant Capacity Average Daily Usage GPD	Treatment	Laboratory Control	Distribution Storage Non-gravity Gravity Gallons	Improvements Needed
600,000	-- 15,000	None --	None	-- 15,000	Underground source, transmission, treatment
		None	None		
360,000 640,000	-- 250,000	None --	None	1,000,000	Transmission, treatment
-- 280,000	40,000	None	None	40,000	None
-- 80,000	-- 50,000	None --	None	100,000	--
-- 100,000	-- 50,000	None	None	-- 30,000	Surface source, distribution system, elevated storage
-- 504,000	-- 140,000	None	None	-- 50,000	Underground source
-- 3,300,000	-- 450,000	None	None	-- 565,000	Distribution system
75,000 --	--	None	None	-- 1,000	Underground source, treatment, distribution system, elevated storage
5,000,000	3,000,000 653,000	Purification-alum, lime, chlorine gas, rapid gravity sand filters, slow mechanical mixing, open sedimentation basin	Complete	-- 300,000	Pumping, ground storage
-- --	-- --	None	None	3,000 --	Elevated storage
-- 50,000	-- --	None	None	1,000 --	--
-- 90,000	-- 11,000	None	None	-- 36,000	None
-- 80,000	-- 9,000	None	None	-- 18,000	--
-- --	-- 31,000	None	None	-- 100,000	None
-- 25,000	-- 14,000	None	None	30,000 --	None
-- 28,000		None	None	750 25,000	
116,000 72,000	-- --	None	None	15,000 --	Surface source, treatment, distribution system, elevated storage
-- 430,000	-- 42,000	None	None	3,000 --	
1,440,000 --	-- 120,000	None	None	150,000 230,000	Surface source, treatment, distribution system

Table 47. Acreage covered by Ground- and Surface-water Irrigation in the Nooksack River Report Area.

Area Basin	Ground Water	Surface Water	Total Irrigation
Main Nooksack River (Including Unnamed Slough, Unnamed Tributary, and Unnamed Brook)	636.00	1,201.5*	1,837.5*
Tenmile Creek (including Lake Fazon)	1,563.75	1,194.0	2,757.75
Wiser Lake Creek	856.50	528.0	1,384.50
Schneider Ditch (including Willey Lake)	346.00	531.0	877.00
Bertrand Creek	2,103.00	645.0	2,748.00
Fishtrap Creek	1,416.00	427.0*	1,843.00*
Scott Ditch	325.50	617.5	943.00
Stickney Slough	703.00	206.0	909.00
Anderson Creek	47.00	106.1	153.10
Smith Creek	149.17	63.0	212.17
South Fork Nooksack River	130.00	215.0	345.00
Middle Fork Nooksack River	0	0	0
North Fork Nooksack River	93.60	105.5	199.10
Germans Creek	0	26.0	26.00
Dakota Creek	500.06	245.0	745.06
California Creek	522.00	197.0	719.00
Unnamed to Salt Water	10.00	88.0	98.00
Terrell Creek	5.00	100.0	105.00
Lummi (Red) River	110.00	335.0	445.00
Silver Creek	174.00	307.0	481.00
Lummi Island	2.50	200.0	202.50
Sumas River (including Sumas Drainage Ditch and Saar, Kinney, Breckenridge, Swift, and Goodwin Creeks)	1,408.00	913.0	2,321.00
Johnson Creek	1,017.50	683.0	1,700.50
Judson (Boundary) Lake	190.00	150.0	340.00
SUB-TOTAL	12,308.58	9,067.6	
		GRAND TOTAL	21,376.18

* Duplication - therefore sum does not equal total.

In comparison, figure 62 is based on the total annual runoff at Lynden and shows the small amount (11.1 percent) of the total that actually is appropriated, including 73,000 acre-feet (2.9 percent) for estimated pollution dilution. Of the 2,540,000 acre-feet flowing past the Lynden gage annually, 282,400 acre-feet are demanded by present uses, including pollution dilution; 1,150,000 acre-feet could be stored at the three sites shown in figure 62, while 1,107,600 is classified as non-controlled. Because of the Nooksack River's streamflow characteristics, however, a major portion of this 1,107,600 acre-feet could be used through efficient control of the three storage sites.

As these figures show, the bulk of the appropriated water is for municipal water systems. Table 46 gives additional facts concerning these community and municipal water systems; figure 63 shows the areal extent of the report area served by these systems.

Irrigation is the next largest authorized use and the largest present use within the study area. Table 47 lists the acreage covered under existing ground-water and surface-water rights for each major sub-basin within the study area. This table does not necessarily correspond with table 45 as some of the smaller basins have been included in larger ones for simplicity in table 47.

There are other smaller uses in the study area that are discussed in more detail under the specific sub-basins. There are also uses such as recreation and fish propagation which must be considered even though water rights are not always issued for these purposes.

The Division of Water Resources recognizes and respects the needs of fish and game for the use of surface waters. Several aspects are considered: water rights for fish propagation, for specific use in fishways, and for stream benefits for the support of its fishery. The Departments of Fisheries and Game were consulted to appraise the fishery value of various streams within the study area and information was provided as to the portions of streams utilized by salmon for spawning purposes. These areas are shown on plate 9.

Although only the known spawning and migration areas are shown in red on plate 9, these streams also benefit fingerlings by providing rearing areas which have suitable food supplies. The species vary in their length of residence in fresh-water streams prior to migration to the sea. This residence may be from three months to a year in time. The Department of Fisheries and the Department of Game have requested that the eight streams or drainages listed in table 48 be closed to further consumptive water right appropriations in the interest of protection to the fishery of these streams. This closure does not apply to domestic or stock water diversions. Occasionally, streams closed for the purposes stated above, may be reappraised and reopened to appropriation.

Table 48. Streams Closed to Further Appropriation.

NOOKSACK RIVER BASIN Bertrand Creek Drainage Fishtrap Creek Drainage Kamm Ditch--tributary Stickney Slough Wiser Lake Creek Drainage
COASTAL AREA BASINS California Creek Drainage Dakota Creek Drainage
SUMAS RIVER BASIN Clearbrook Creek--tributary Johnson Creek Elkins Creek--tributary Breckenridge Creek

Appropriation from these streams may be permitted with certain low flow provisions and diversions will be restricted to periods when the flow of the streams exceed those established flows. An additional four streams are subjected to low flow restrictions in the specific locations outlined in table 49. Streams not listed in either tables 48 or 49 are still subject to appropriation.

Table 49. Streams Available for Appropriation, Subject to Designated Low-flow Restrictions.

NOOKSACK RIVER BASIN Deer Creek - minimum flow--1.5 cfs directly above its confluence with Tenmile Creek. Fourmile Creek - minimum flow--1.0 cfs from stream crossing at north section line of Sec. 17, Twp. 39 N., Rge. 3 E.W.M., upstream to Green Lake. minimum flow--1.5 cfs from above crossing, downstream to its confluence with Tenmile Creek. Tenmile Creek - minimum flow--4.5 cfs directly above its confluence with Fourmile Creek. minimum flow--6.0 cfs from Fourmile Creek, downstream to Deer Creek. minimum flow--7.5 cfs from Deer Creek to Nooksack River.
SUMAS RIVER BASIN Breckenridge Creek - minimum flow--2.0 cfs June 1 to October 1 at center line of Sec. 24, Twp. 40 N., Rge. 4 E. minimum flow--3.0 cfs October 1 to June 1 at center line of Sec. 24, Twp. 40 N., Rge. 4 E.

The considerations of these departments are to utilize to the full capacity the available water of these streams for the full potential fishery value. This is tendered in consideration of the known existing uses of water and with full appreciation of all benefits to be derived from these waters.

The following paragraphs deal with present water use in the specific sub-basins within the report area. These discussions are based on tables 45 and 47 and appendices A and B are intended to present only a brief resume' of use by basin. More detailed facts and figures relating to low flows do not come under the scope of present use and have been discussed and tabulated in the section of this report dealing with streamflow analyses.

MAIN NOOKSACK RIVER

As figure 61 shows, there is an abundance of water available for appropriation in the Nooksack River since the main stem, which extends from the junction of the North and Middle Forks to its mouth at Marietta, has only 19.425 cubic feet per second appropriated. The two largest rights are for 5.00 cubic feet per second each, one being for manufacturing by General Petroleum Company and the other for municipal use by the city of Lynden. There is an additional domestic right for 0.01 of a cubic foot per second from the Nooksack River, but the balance of the 9.415 cubic feet per second that has been appropriated is used for the irrigation of 964.5 acres. There are 636.0 acres irrigated from ground-water sources in approximately the same area.

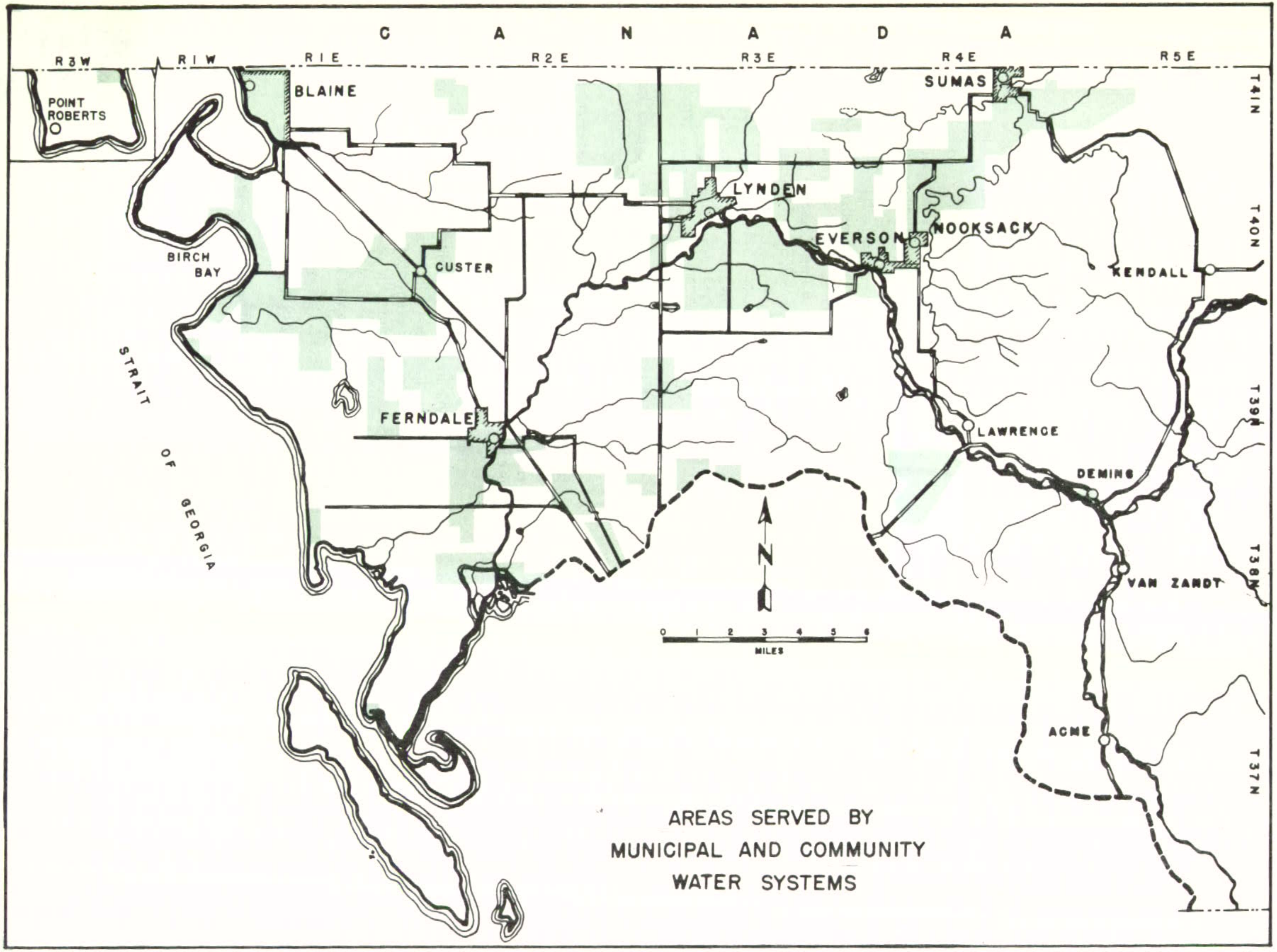
C A N A D A
R 3 W
R 1 W
R 1 E
R 2 E
R 3 E
R 4 E
R 5 E
T 41 N
T 40 N
T 39 N
T 38 N
T 37 N
POINT ROBERTS
BLAINE
SUMAS
LYNDEN
EVERSON
NOOKSACK
KENDALL
BIRCH BAY
CUSTER
STRAIT OF GEORGIA
FERNDALE
LAWRENCE
DEMING
VAN ZANDT
ACME
N
0 1 2 3 4 5 6
MILES
AREAS SERVED BY
MUNICIPAL AND COMMUNITY
WATER SYSTEMS

Figure 63.

TENMILE CREEK

This relatively small drainage basin of only 34 square miles has the largest amount of irrigation by surface water for any single basin in the study area. There have been 12.605 cubic feet per second appropriated here for the irrigation of 1,064.0 acres, while an additional 1,563.75 acres are irrigated from ground water. Seven of the 45 rights in this basin recognize a total domestic diversion of 0.065 of a cubic foot per second, and an additional 0.04 of a cubic foot per second is listed as other consumptive diversions for domestic garden irrigation. A non-consumptive diversion estimated at 0.69 of a cubic foot per second is used for fish propagation near Barrett Lake.

Due to the large number of diversions in this basin, extensive low-flow restrictions have been placed on the appropriation of additional water. These restrictions maintain streamflows for fish and game propagation and are outlined in detail in table 49. From a pactical viewpoint, these restrictions prevent additional diversion during low-flow periods except during extremely wet years. Water is, however, still available during the early portions of the irrigation season.

There are at least four possible storage sites in the Tenmile Creek basin which could augment the flow during low-flow periods. Development of the Barrett Lake, Deer Creek, Green Lake, and Tenmile Creek sites could provide water for the irrigation of much additional land. Table 33 on page 109 and plate 8 provide more detailed information concerning these sites.

UNNAMED TRIBUTARY OF THE NOOKSACK RIVER

This small unnamed stream, north of Tenmile Creek, is listed separately because the single water right from this stream does not affect any of the drainages other than the Nooksack itself. Very little is known about this drainage, and the one water right amounts to 0.67 of a cubic foot per second for the irrigation of 70 acres. All irrigation by ground water in this basin is included in the total for the Main Nooksack River.

WISER LAKE CREEK

This small stream and lake are heavily appropriated and for this reason is included in table 48 as being closed to further appropriation. The authorized diversion of 4.03 cubic feet per second is for the irrigation of 528 acres of land, while 856.5 acres is allowed under ground-water rights. An additional 0.02 of a cubic foot per second is specified for domestic uses which likely are garden and lawn irrigation.

SCHNEIDER DITCH

This small, heavily appropriated drainage ditch is used exclusively for irrigation purposes with 2.91 cubic feet per second being allowed for the irrigation of 371 acres. Ground-water irrigation here amounts to 346 acres which includes the Willey Lake drainage. Available water is dependent on ground-water discharge, but it appears that there is little water for appropriation during the low-flow period.

BERTRAND CREEK

The sixteen filings in the Bertrand Creek drainage are all for irrigation, although domestic supply is mentioned in three instances for a total of 0.03 of a cubic foot per second. The irrigation rights total 6.51 cubic feet per second for the irrigation of 645 acres. Ground water provides irrigation for an impressive 2,103 acres which makes this the largest ground-water irrigation basin in the study area.

Bertrand Creek has been closed for further appropriation due to its intrinsic value for recreation and fish propagation. Occasional rights are granted on intermittent tributaries, however, where such diversion will not affect the low flow of Bertrand Creek.

Development of the Markworth Road and Upper Bertrand storage sites could materially aid the flow in the respective tributaries on which they are located as well as providing additional flow in Bertrand Creek proper.

FISHTRAP CREEK

This stream roughly parallels Bertrand Creek, and like Bertrand Creek, is closed to further appropriation. Of the total appropriated quantity of 10.87 cubic feet per second, 4.32 cubic feet per second are authorized for the irrigation of 427 acres of land. This compares with 1,416 acres permitted under ground-water rights and exemplifies the availability of ground water in this and the Bertrand Creek area.

There are two large diversions in the basin. The older, from Fishtrap Creek, is the Whatcom County Dairymens' Association right for 1.55 cubic feet per second for fire protection and manufacturing. The Double Ditch Water Association has the other large right, 5.0 cubic feet per second from the Double Ditches to be used for domestic, stock, and garden irrigation. This area is now included in the Delta Water Association, so it is doubtful if more than a small part of this 5.0 cubic feet per second right is actually being diverted.

SCOTT DITCH

This drainage lies across the Nooksack River from Fishtrap Creek and insofar as surface water is concerned is used exclusively for irrigation. The flow is largely appropriated with 6.08 cubic feet per second being the authorized diversion for the irrigation of 617.5 acres. An additional 325.5 acres are covered under ground-water rights.

STICKNEY SLOUGH

This is a small basin with a relatively small amount of water being appropriated. Only 2.04 cubic feet per second have been appropriated with 2.00 cubic feet per second, the largest use being for the irrigation of 206 acres of land. Irrigation by ground water amounts to 703 acres and again reflects the excellent aquifers beneath the Lynden area. Domestic supply accounts for a diversion of 0.01 of a cubic foot per second while stock-water requirements account for the balance for 0.03 of a cubic foot per second.

Although the Kamm Ditch portion of this drainage is closed to further appropriation (tab. 48) the entire lower portion of the basin still appears to have an abundant supply of available water.

ANDERSON CREEK

As discussed in the streamflow section, the flows in this drainage are not as well sustained as those previously mentioned. Therefore, storage must be considered for any large use during low-flow periods. The two large potential storages here (tab. 33) could conserve about 4,500 acre-feet for use during the critical low-flow period. Plate 8 shows the location of these two sites, which are called Anderson Creek and Kelly Road reservoir sites.

With the limited surface water supply available, only 1.061 cubic feet per second have been appropriated for the irrigation of 106.1 acres. Irrigation by ground water is also very limited with only 47 acres being covered by present rights. Domestic supplies account for 0.08 of a cubic foot per second while a surprisingly large quantity of 1.10 cubic feet per second is claimed by the Glen Echo Coal Company for mining and power purposes. At present this organization has ceased operations, but use of the property has been transferred to the Whatcom-Skagit Rendering Company. Information from the Pollution Control Commission indicates that the rendering company is presently using up to 10,000 gallons per day, but this at most amounts to about 0.05 of a cubic foot per second and would have only a minor effect on the stream's total flow.

SMITH CREEK

This stream, like Anderson Creek, exhibits extremely variable flows; however, there are no storage sites known here to augment the low flow. Presently authorized surface-water use is very small with only 0.50 of a cubic foot per second being appropriated to date. Of this, 0.48 of a cubic foot per second is for the irrigation of 63 acres, while the remaining 0.02 of a cubic foot per second is for domestic supplies. Ground-water use, similarly, is quite small with only 149.17 acres authorized for irrigation.

SOUTH FORK NOOKSACK RIVER

This large stream and its tributaries are relatively untapped, insofar as surface-water use is concerned. The authorized diversions total 54.81 cubic feet per second, but 50 cubic feet per second of this is for municipal use by the city of Bellingham and is not yet being used. Furthermore, Bellingham is presently developing the Middle Fork and it is unlikely that the South Fork will beutilized for some time, if ever, under this permit. Of the remaining 4.81 cubic feet per second, 2.75 cubic feet per second are for non-consumptive use in millponds while 0.07 of a cubic foot per second is for domestic and community domestic supplies. Only 1.99 cubic feet per second have been appropriated for irrigation with 215 acres covered under seven rights. The extent of the irrigation by ground water in this entire basin is only 130 acres.

The development of any of the major reservoir sites on the South Fork as discussed in the reservoir section of this report would materially change the amount of water available from that source.

MIDDLE FORK NOOKSACK RIVER

Although 250.10 cubic feet per second have been authorized for diversion from the Middle Fork, present surface-water use is negligible since Bellingham has not yet completed its diversion dam and pipeline designed to take the 250 cubic feet per second authorized by permit, while the Chicago, Milwaukee, St. Paul and Pacific Railroad's right of 0.10 of a cubic foot per second from Canyon Creek is believed abandoned. There are no recorded rights for either ground or surface-water irrigation in the basin.

NORTH FORK NOOKSACK RIVER

This fork has the largest amount of present use of the three forks of the Nooksack River. Although only 93.6 acres are covered by ground-water rights, 22 valid surface-water filings are on record for a total appropriation of 10.83 cubic feet per second. Three of these rights are for irrigation with 1.06 cubic feet per second provided for 105.5 acres. Domestic and community domestic uses amount to 1.75 cubic feet per second with the largest right belonging to the Baptist General Convention for 1.00 cubic foot per second from an unnamed tributary of the North Fork.

A total of 8.02 cubic feet per second is recorded for non-consumptive purposes, the largest being 3.00 cubic feet per second for fish propagation from the North Fork near Kendall. Other large non-consumptive uses include 2.00 cubic feet per second from an unnamed stream for power for the State Department of Highways, and 0.80 of a cubic foot per second from Galena Creek by the Mt. Baker Ski Club for hydro-electric power. Private individuals hold rights to 2.08 cubic feet per second for power production in the Maple Creek drainage. It is quite doubtful whether many of these power rights are utilized at present. It is known that the Ski Club's diversion is inactive; it is entirely possible that the others are not used.

The largest use in the basin is that of Puget Sound Power and Light Company at its Nooksack Power Plant. This diversion is not recorded in the water-right tabulations as the company claims a vested right to the use of 328 cubic feet per second, of which 35 percent is presently developed.

Development of any of the major reservoir sites in the basin would materially affect the flow and make additional water available. There is also one smaller storage site on Maple Creek; however, this site would flood all the agricultural land in the area and there is no known use for this water that would make the project economically feasible.

WILLEY LAKE, UNNAMED SLOUGH, LAKE FAZON, UNNAMED BROOK

These small drainages are all included in larger drainages for purposes of the ground-water irrigation tabulation in table 47. All are small in area, but combined, they account for diversions amounting to 4.42 cubic feet per second with 4.39 cubic feet per second for irrigation and 0.03 of a cubic foot per second for domestic use.

GERMANS CREEK

This small stream disappears in gravelly soil in the Columbia valley. Despite the small size of its drainage, 0.285 of a cubic foot per second has been appropriated for the irrigation of 26 acres and for domestic purposes. There is no recorded ground-water irrigation in this drainage basin.

DAKOTA CREEK

This is one of the larger sub-basins in the study area, but the diversion of only 2.61 cubic feet per second is authorized. Of this 2.61 cubic feet per second, 0.04 of a cubic foot per second is for domestic use, while 2.57 second feet are used for the irrigation of 245 acres. Ground-water irrigation amounts to 500.06 acres.

The small total amount of diversions is partially due to the basin being closed to further appropriation because of the importance of the fishery resource.

Development of the one small storage site on Dakota Creek would not aid materially in flow stabilization. The development's primary purpose would be to reclaim the tidal zone of Dakota Creek by converting it into a fresh-water lake. A certain amount of water would be available for irrigation or other use, but the primary value would be aesthetic.

CALIFORNIA CREEK

This basin is similar to the Dakota Creek drainage in that it is also closed to further appropriation and has a storage site similar to that on Dakota Creek. The drainage is somewhat smaller, and only 1.48 cubic feet per second have been appropriated here. The irrigation of 197 acres accounts for the use of 1.47 cubic feet per second, the remaining 0.01 of a cubic foot per second is for domestic use. There are also 522 acres of authorized ground-water irrigation here.

UNNAMED TO SALT WATER

Several small streams and ditches are for simplicity combined under this heading. Total authorized irrigation in these drainages amounts to 10 acres from ground-water sources and 88 acres with 0.80 of a cubic foot per second from surface water.

Total surface-water diversions amount to 1.16 second feet. In addition to 0.80 of a cubic foot per second for irrigation, other consumptive uses amount to 0.06 of a cubic foot per second with 0.04 of a cubic foot per second being used for domestic supply and 0.02 of a cubic foot per second for stock-water purposes. The 0.03 of a cubic foot per second for non-consumptive purposes is from an unnamed spring and is used for fish propagation.

The amount of water still available for appropriation has not been determined and would require careful field investigations in each case.

TERRELL CREEK

This stream goes dry during the summer months so additional summer use is dependent upon storage. Other than private farm ponds, the only apparent storage site would be increased storage in Lake Terrell. The State Department of Game now holds a right to store 5,600 acre-feet here which is used for fish and wildlife propagation. Raising the outlet structure a few feet could increase the capacity 2,000 to 3,000 acre-feet which through controlled discharge could provide water for the irrigation of an additional 1,000 acres or more.

The total extent of ground-water irrigation in this drainage is only 5 acres which exemplifies the extreme ground-water shortage here. Total surface-water diversions amount to 1.00 cubic foot per second for the irrigation of 100 acres. Authorized storage amounts to 5,644 acre-feet with 5,600 of this being the State Department of Game's project and the balance of 44 acre-feet for two private reservoirs used primarily for irrigation.

LUMMI (RED) RIVER

Total irrigation in this drainage is 110 acres from ground water and 335 acres from surface sources. A total of 3.35 cubic feet per second is diverted with all of it used for irrigation. Of this amount about 2.50 second feet are from the Lummi River itself. As the Lummi River is a controlled distributary of the Nooksack River, much additional acreage could be irrigated as the need arises.

SILVER CREEK

This small stream has 19 valid filings and is one of the most heavily appropriated streams in the study area with a total of 3.026 cubic feet per second of authorized diversions.

Twelve of these filings are for irrigation purposes with 2.82 cubic feet per second and 307 acres covered under this use. This compares with 174 acres of authorized ground-water irrigation. Domestic and group domestic use amounts to 0.155 of a second foot while 0.046 of a cubic foot per second for stock water completes the consumptive use. A fish propagation use of 0.005 of a cubic foot per second is the only non-consumptive use in this basin.

Although this creek is still subject to further appropriation, there is little if any excess water during low-flow periods. No storage sites have been noted in this drainage.

LUMMI ISLAND

Only 2.5 acres of irrigation are authorized by ground-water rights here while surface-water irrigation encompasses 200 acres. This 200 acres is all irrigated from the F. Baker diversion dam project, which also produces power for emergency domestic use as well as a domestic water supply. Total surface water use on the island amounts to 3.36 cubic feet per second plus one right currently being processed. Irrigation accounts for 2.00 second feet, domestic and community domestic 1.145 cubic feet per second, and stock 0.005 of a cubic foot per second, and a non-consumptive power use of 0.21 of a cubic foot per second. The majority of the large amount for community domestic is presently undeveloped, pending subdivision development on the island.

No large storage sites are known to exist on the Island, although several smaller sites such as the F. Baker diversion site may salvage enough water for limited projects.

SUMAS RIVER

Table 47 combines all the irrigation in the Sumas Drainage Ditch and Saar, Kinney, Breckenridge, Swift, and Goodwin Creeks in the Sumas River drainage.

Ground-water irrigation amounts to 1,408 acres as compared with 913 acres from surface-water sources. Only 5.69 cubic feet per second, used to irrigate 583.5 acres, are from the Sumas River itself, however. There is no other surface water use from the Sumas River. There appears to be ample water still available from the Sumas even though there are no apparent storage sites to augment low flows here.

The Sumas River and tributary streams are not indicated as spawning streams on plate 9, as fish patterns of use are extremely sporadic and irregular due to the international complexities of fish protection for migratory fish desiring to return to this region. This is due in part to the unnatural streamflow regulation discussed in the streamflow analysis and evaluation section of this report.

SAAR CREEK

The total appropriated quantity here amounts to 1.52 cubic feet per second, none of which is from Saar Creek itself. This breaks down to 0.03 of a cubic foot per second for domestic, 0.97 of a cubic foot per second for dairy operation, plus non-consumptive uses of 0.02 of a cubic foot per second for fish propagation and 0.50 of a second foot for power. It is not known how much of this is actually being used at present although there still appears to be ample water available in these tributaries.

Saar Creek would require development of the Saar Creek minor storage site (tab. 33) for any effective water utilization program, especially during the low-flow period. This site would also provide flood protection for the lower basin.

SUMAS DRAINAGE DITCH

This ditch has but one water right listed. It amounts to 0.29 of a cubic foot per second for the irrigation of 29 acres. There is no information as to the present availability of water here.

JOHNSON CREEK

This drainage basin is the largest tributary of the Sumas River and has a total of 1,700.5 acres of authorized irrigation, 1,017.5 of which is from ground-water sources.

The surface water irrigation amounts to 683 acres using 6.65 cubic feet per second. An additional large use in this basin is 3.13 cubic feet per second for domestic and municipal supplies with 3.12 cubic feet per second of this derived from springs for use by the city of Sumas.

Although Clearbrook Creek, a small tributary of Johnson Creek, is closed to further appropriation, there still appears to be sufficient water available for future diversions in the remainder of the drainage.

KINNEY CREEK

This small tributary of the Sumas River has only one water right which amounts to 0.25 of a cubic foot per second for the irrigation of 25 acres. The amount of water still available here, if any, is not known at present.

BRECKENRIDGE CREEK

Breckenridge Creek has three authorized diversions, all of which are for irrigation. A total of 0.55 of a cubic foot per second has been appropriated for the irrigation of 95 acres. Breckenridge Creek is subject to the low-flow restrictions listed in table 49 because of its intrinsic value as a fishery resource. Elkins Creek, a small tributary of Breckenridge Creek, is completely closed to further appropriation for the same reason.

SWIFT CREEK

The one water right from this stream provides 0.40 of a cubic foot per second for the irrigation of 40 acres plus an additional domestic use of 0.01 of a cubic foot per second. Despite this limited use, there does not appear to be much water available for appropriation during the low flow period, although runoff waters are plentiful.

GOODWIN CREEK

This small drainage has five valid filings which total 1.20 cubic feet per second. They provide 1.19 cubic feet per second for the irrigation of 140.5 acres and 0.01 of a cubic foot per second for domestic use. Although this is a heavy appropriation for such a small stream, considerable water still appears to be available.

JUDSON LAKE

This drainage includes irrigation rights for 190 acres from ground-water sources and 150 acres using 1.50 cubic feet per second from the lake drainage itself. Abundant water for anticipated needs is still available here.

SUMMARY

CONCLUSIONS

It has been concluded from this study that the quantity and quality of naturally occurring waters in the Nooksack River basin are adequate to meet the needs of the area for many years to come. Actually the present low-flow demand against the Nooksack River proper, as indicated by water rights, amounts to 255.26 cubic feet per second or 26.7 percent of the mean annual low flow of the river as gaged at Lynden. This demand represents only about 10 percent of the total average annual runoff of 2,540,000 acre-feet gaged at Lynden.

In comparing the climate, geology, and hydrology of the Nooksack River basin to other regions, it is evident that here nature has provided an unusual setting suitable for the production of large quantities of water of excellent quality. These complex, integrated natural phenomena have resulted in a river basin containing two distinct climatic regions: the heavily populated lowland area of the Whatcom Basin which is adequately instrumented to define its climatology, and the less accessible mountainous region of the Eastern Upland which produces much of the area's water supply, but which is essentially devoid of hydro-climatic data. Meteorology in this mountainous region is characterized by an extreme variability with altitude and exposure.

One of the obvious shortcomings is the inability of the present network of precipitation stations to define the aerial distribution of precipitation. Over the Nooksack River basin annual precipitation ranges from 30 to over 200 inches, and to sample this distribution even in 10-inch increments would require a minimum of 17 measuring points within the basin. At the present time, sampling density is sufficient in the elevation area from sea level to 1,000 feet, while in the area above 1,000 feet, which receives the heaviest amounts of precipitation, sampling stations are entirely inadequate.

Approximately 85 percent of the precipitation and 60 percent of the total runoff from the Nooksack River basin occurs during the seven water-surplus months, October through April, which are corresponding periods of low demand. It then becomes evident that upstream storage in artificial reservoirs will be required to bring flow characteristics more in line with periods of demand.

Ground-water resources in the Whatcom Basin part of the report area and in the lower river valleys of the three major forks of the Nooksack River within the Eastern Uplands are adequate to meet those areas' requirements where water supplies are not obtained from the Nooksack River and other surface-water supplies.

Some small areas within the Whatcom Basin, principally the till-capped uplands around the periphery of the basin, are deficient in ground water. Limited areas also exist within the basin where the high iron content of the water severely limits its usability for household and some industrial supplies.

Recessional outwash sand and gravel associated with Vashon glaciation and river-laid sand and gravel contiguous to the Nooksack River are the major producers of ground water. However, in some areas wells extending beneath the Vashon till have obtained moderate amounts of water of good quality from advance outwash materials or other unconsolidated sand and gravel formations beneath the Vashon till.

The Tertiary sedimentary and pre-Tertiary metamorphic rocks restricted almost entirely to the Eastern Upland area are capable of producing only small amounts of ground water and quite often where production is obtained from those rocks, the quality is poor. Oil test wells in the Whatcom Basin which encountered Tertiary rocks of the Chuckanut formation beneath the glacial drift produced connate water or water otherwise extremely high in chloride.

Hydrographs of observation wells within the Whatcom Basin have shown no trend suggesting that annual withdrawals of ground water are exceeding natural recharge. These hydrographs together with an evaluation of pump test data studied during the investigation have led to the conclusion that much additional ground water may be developed from the major areas of production with assurance that water withdrawn will be replaced annually during the recharge period.

It can be concluded from this inventory and analysis that it is not possible to make an accurate and complete quantitative water-resource evaluation of the Nooksack basin from basic data in existence at this time. At present there appears to be no immediate need for large scale water-resource development in this area, but with an inevitable increase in future use, the time will come when it will become necessary to utilize all available water in the most efficient manner possible. In preparing for this eventuality it seems logical to start by studying the problem as soon as possible. Before such a study can be undertaken, however, accurate knowledge of the area's water budget must first be known and this information can be obtained only by an intensive and comprehensive program of basic data collection.

One means of gathering the various types of hydrologic data is to proceed as in the past by slowly augmenting the state-wide network with a few scattered instrumentation stations each year. In this procedure, however, stations are usually established where local needs demand information and less consideration is given to the station's location from the standpoint of its overall value in water-resource analysis. In the past this program has maintained a number of stations with short term or discontinuous periods of record which do not coincide in time with other data-gathering stations in the area. As a result it is difficult to draw conclusions from these data with any reasonable assurance of accuracy.

A second method would be to saturate the basin with data-collecting stations for a period of not less than 3 years. At the conclusion of the observation period, data from each of the stations would be thoroughly evaluated and those which produce the best data would be retained as permanent stations and the rest removed for installation in other basins. This latter program, though extremely costly, would furnish the data required for a thorough and accurate quantitative evaluation of the water resources of the study area.

The chemical quality of the ground waters of the Nooksack River basin ranges from excellent to very poor. In most areas of the Whatcom Basin, the ground water is good to excellent with a few isolated areas of poor quality water due to high iron content. On the basis of available analysis, shallow wells appear to produce water of better quality than deeper wells with the exception of the iron-rich areas around Everson, Deming, Lynden and in the Sumas River lowland.

The waters of the Nooksack River and adjacent streams are of excellent quality throughout the basin. They are soft, low in mineralization, relatively free of pollution, and suitable for municipal, agricultural, recreational, and most industrial uses. Analysis available at the time of the study disclosed the iron content of the Nooksack River water to increase progressively downstream. This moderate quantity of iron in the lower reaches of the river, together with suspended sediment load, are the most objectionable characteristics found in Nooksack River water.

There is considerable undeveloped hydro-electric power, flood control and water-storage capacities in the reservoir sites studied during the Nooksack River investigation. Capacities of the four major utilization areas studied are as follows:

North Fork - 24,500 KW of firm power,
200,000 acre-feet of storage.
South Fork - 24,200 KW of firm power,
450,000 acre-feet of storage.
Maple Falls - 8,900 KW of firm power,
usable storage negligible.
Deming - 13,200 KW of firm power,
500,000 acre-feet of storage.

Complete development of these major sites will be dependent upon multiple-use programs since the cost of development for power purposes, water storage or flood control alone makes development economically unfeasible.

There are a number of minor dam and reservoir sites within the study area which were not studied in detail nor was their feasibility determined. Development of these minor storage sites by communities or water-use groups may provide a solution for water-short areas in some of the smaller sub-basins.

A water-use survey of the basin has shown that approximately 700 cubic feet per second of water is available for appropriation from the main stem of the Nooksack River. This figure is based upon average annual low flow records obtained at the Lynden gage site. The natural low flow ofthe Middle Fork of the Nooksack River has been appropriated by the City of Bellinghamto satisfy its municipal demand. Further appropriation from the Middle Fork during the summer months would require upstream storage.

Water is still available for appropriation from the North and South Forks of the Nooksack River as well as most of the tributaries thereto.

Some of the smaller tributaries of the main stem of the Nooksack River, as well as some of the non-tributary streams in the study area, have been heavily appropriated or closed to further appropriation. Water supplies, for further development of these areas deficient in surface water, will have to come from ground water supplies or development of artificial storage at some of the smaller reservoir sites.

A search of records at the Whatcom County Auditor's office has shown that there are a few vested claims to use of water (established prior to the State Water Code) from the Nooksack River and some of the related streams within the study area; however, a cost-benefit evaluation suggests that an adjudication of these rights is not warrented at this time.

RECOMMENDATIONS

With the publication of this report, "Water Resources of the Nooksack River Basin and Certain Adjacent Streams", the responsibility of the Division of Water Resources in matters pertaining to administration and planning for water resource development within the study area does not end. The completion of the inventory terminates one phase of a water resources program which should be followed by planning and culminating with actual development of projects within the basin. Conclusions drawn from this investigation have shown that, although the area is endowed with an extremely large water resource, there still remains much additional work to be done if the people residing in the area are to realize the full benefit of the maximum potential of this valuable resource. To assist those who will be charged with the responsibility of planning and developing the area's water resources, the authors offer the following recommendations:

1. It is recommended that a water resource committee be created which would be representative of all interests concerned with the proper conservation, development and ultimate uses of the available water resource in the study area.

Such a committee would serve to represent the local people and would meet with county, state and federal planning groups in the preparation of a program for orderly and complete development of the area's water resources.

One of the first programs for the water resources committee should be to review the Nooksack River inventory report and, on the basis of the data included therein, develop a water resource plan for the basin. The plan should consider such problems as: Sequence of development of water utilization and storage areas on the three major forks of the Nooksack River; ways in which present supplies could be more beneficially used; the need for a comprehensive water distribution system to serve those areas where adequate local supplies are lacking; the need for land-use zoning to assure that interim development of lands to be inundated will not make utilization of storage sites economically unfeasible.

2. It has been concluded from the study that the hydroclimatic network in the Nooksack River basin is inadequate to accurately define and evaluate all the components contributing to runoff. Also, the present demand on the water resources of the area do not require other than a casual knowledge of runoff furnished by stream-flow measurements. Therefore, piecemeal addition of hydroclimatic stations are not economically justified and therefore are not recommended for the Nooksack River basin.

At some future date when a more complete knowledge of all factors contributing to runoff becomes necessary, it is strongly recommended that consideration be given for establishing an instrumentation saturation study for the Nooksack River basin. The proposed saturation study is discussed in more detail in an addendum to the recommendations.

3. As the foregoing report discloses, the Whatcom Basin portion of the Nooksack River watershed, with only a few exceptions, possesses a ground water supply that is adequate to fulfill its needs for the present and foreseeable

future. However, certain characteristics of ground-water occurrence and movement here should be studied in greater detail so that answers may be forthcoming to questions that may arise from future problems relating to both ground and surface waters and their inter-relationship within the report area. It is thereforerecommended that the following aspects of ground water hydrology be studied further:

A. The rate and direction of ground-water movement, particularly with regard to the apparently large supply of ground-water inflow to the Nooksack River below the Deming gage, should be studied to determine how much ground water is contributed from within the report area itself, as compared to the quantity that may move southward from ground-water reservoirs located north of the Canadian border.

B. The ground-water potential of the wide lower valley bottoms of the three main Nooksack tributaries should be studied. Although much of the farming here depends, at present, on direct precipitation rather than irrigation from wells, it would be helpful to check into the characteristics of the local ground-water bodies by a program of drilling deep test wells.

C. The relationship between ground water and surface water should be studied to determine the possible contaminating effects that each source may have upon the other.

D. In order to determine more widely the annual and long-time fluctuation of the water table, it is recommended that a network of observation wells be established throughout the report area, using automatically operating and continuously-recording instruments.

4. As indicated by the streamflow analysis, basic streamflow data is lacking on many streams in the report area and before a more comprehensive water-budget evaluation can be made it would be necessary to greatly enlarge the existing stream-gage network. This is not possible under the present program of data collection, but much of the missing information could be obtained by installing a few additional stream gages at certain critical locations. It is therefor recommended that the following gaging sites be given top priority when considering expansions of the present stream-gaging network:

A. Nooksack River at Ferndale

A gage should be installed here to measure the total flow of the Nooksack River and essentially all of its tributaries. This location seems most logical for this purpose because only a negligible amount of direct runoff enters the main stem below Ferndale. A gage located farther downstream would be affected by tidal action. Records obtained at this site in conjunction with those obtained at Lynden and Deming would also provide information on ground-water inflow to the Nooksack River.

B. Nooksack River at Deming

If at all possible,this station should be re-established as it is situated in a unique natural location to measure practically all of the runoff from the mountainous portion of the watershed. This station also provides necessary information for studying ground-water contribution in the Whatcom Basin.
From a hydrologic standpoint, streamflow data collected on the Nooksack River at Lynden is less valuable than data obtained at either Ferndale or Deming. It is therefor suggested that the Lynden gage be moved to either the Ferndale or Deming site, if sufficient funds are not available to install and maintain gages at the three sites.

C. Tenmile Creek above Barrett Lake

The Tenmile Creek system drains a major portion of the Whatcom Basin and its waters are the most heavily appropriated. Streamflow data on this stream would therefor provide much needed information for proper regulation of diversions and would provide an accurate measure of usable water produced by this part of the report area.

D. Sumas River at Sumas

The existing two years of streamflow record on the Sumas River are inadequate to accurately establish its runoff characteristics and, because this stream system occupies more than 7 per cent of the area studied and its waters are highly appropriated, additional streamflow data would be of great value.

E. Glacier Creek above Falls Creek

In the past, research projects in glaciology have been conducted on the Coleman Glacier and the installation of a stream gage at this location would help to provide much needed information in determining the role played by glaciers in the hydrologic cycle.

5. Recommended water-sampling program

A. The basin-wide observation well program should be expanded to more adequately show amounts of water in storage and/or water quality changes. Well-defined sampling programs should accompany water level measurements to ascertain those areas producing water of unsuitable quality. Iron, nitrate, sodium, and chloride are constituents which may make supplies unsuitable, and the extent of the concentration in undesirable amounts should be determined. Observation wells located close to the sea coast should be sampled periodically to detect changes which may indicate salt water intrusion before it can become a serious problem.

B. A temporary concentrated surface-water sampling program is recommended to more adequately determine the present water quality. This concentrated program would require a daily sampling station at Ferndale with numerous miscellaneous samples collected from various points throughout the basin. The program should continue for at least one complete water year.
Grab samples should be collected from Glacier Creek and from each of the three forks of the Nooksack River above their confluences. Samples should also be collected on the main stem of the Nooksack River above and below the cities of Everson and Lynden. Bertrand Creek, Anderson Creek, Fishtrap Creek, Scott Ditch, Smith Creek, Tenmile Creek and Wiser Lake Creek should also be sampled to determine their affects on the water quality of the Nooksack River proper. In addition, Dakota, California, Terrell, Silver Creeks and the Lummi River which comprise the major coastal streams should be sampled.
In the Sumas River basin, the Sumas and Saar Creeks should be sampled near the Canadian border. Johnson Creek should be sampled above the city of Sumas and the Sumas River should be sampled above the city of Nooksack.
Completed chemical tests (including iron), physical tests, sanitary tests, and limited biological tests should be conducted on all samples. Each sample should also be tested for suspended sediment load.
After completion of this concentrated program, a continuation of the existing permanent station near Lawrence, together with one or two grab samples per year at the other sampling locations should provide adequate data to detect any appreciable quality change which may occur.

6. Although studies have been conducted on the major reservoir sites in the study area, some of the minor dam and reservoir sites should be more completely investigated as to available runoff, geologic feasibility, and actual reservoir capacities. Group, community, or government-cooperative programs appear to be the best approach for development of these storage projects.

The present power potential studies appear adequate for the present time; however, possible development of this power should be reviewed from time to time as changing economic conditions suggest.

7. The primary purpose of a water-use survey is to accurately determine the present water use and thereby estimate the amount of water still available for development. Secondary purposes would be to determine waste and unauthorized diversion and to what extent authorized diversions are being utilized. The present approach for determining water-use estimates has proven inadequate since streamflow measurements and appropriation of water under authorized diversions do not necessarily coincide in time, thereby resulting in erroneous conclusions.

It is recommended that a typical stream within the Nooksack River basin be studied use-wise, to determine to what extent authorized diversions are being utilized at any given time and to learn what effect those diversions actually have upon the flow of the stream below the points of diversion. Results obtained from a typical stream study would be applicable to other similar streams within the basin.

ADDENDUM

Streamflow is the complex resultant of a number of meteorological and geographical components. Precipitation, one of the few components measured in a conventional climatological network, is unquestionably the most important contributing factor. Deposition of fog may be another significant source of supply. Evapotranspiration and interception are negative components, acting to diminish the supply. Factors such as soil moisture storage, deep percolation, accumulation and ablation of snow pack and glaciers further complicate the temporal occurrence of runoff. All these components are intricately integrated both in time and space over the remote regions of the mountain watershed and the synthesis or end product is measured as streamflow.

Precipitation accounts for at least 90 per cent of the annual variability of streamflow. Any program for collection of hydrometeorological data should place emphasis on measuring this important parameter. However, in the Nooksack basin all the convenient sites in the mountain areas where personnel are available have been instrumented. Additions to the network in uninhabited areas are less fruitful and the cost of a data-collection program that would measure all the components of runoff in the remote water-producing mountainous area would certainly not be economically justified as a solution for the Nooksack basin problem.

Unfortunately, the hydrometeorological network in the Nooksack basin is generally typical of those established in other watersheds on the west slope of the Cascades. An overall state-wide expansion will ultimately be required to meet the rising demand for water. Despite the seemingly insurmountable difficulties presented by the rugged terrain, these Cascade watersheds offer a hydrology most susceptible to precise definition by quantitative methods. Therefore, instead of dissipating hydro-climatic data-collection stations in an attempt to sample the wide variability in mountain climates and hydrology on a state-wide basis, the expansion should first be confined to a concentrated effort on one relatively small but representative basin. Since all the components of runoff are intimately related, each requires a knowledge of the other.

Because of the similarity of general climatic conditions and the relative homogeneity of the watersheds of the western slope of the Cascades, the information obtained from a saturated basin study could be applied to other similar areas in western Washington. With this basin as a control, a closer examination of the efficiency of the present state-wide hydrologic network would be possible. Also, recent developments in the use of radar to measure aerial precipitation may antiquate the conventional rain-gage network. The use of radar would be accelerated appreciably if a calibrated basin were available as a control.

Additional benefits could be expected from the use of this calibrated basin to accurately evaluate the effects of present and new weather modification techniques as they develop.

The Nooksack basin is particularly well adapted for such a research project. The gaging site at Deming offers a remarkable control for measuring the entire runoff from the mountainous watershed; also the background obtained from the Nooksack study would be readily available.

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APPENDIX A

Appendix A lists all the recorded ground-water filings in the study area as of January 1, 1960.

These filings are listed according to township and the first column lists them by sections within the township. The next three columns refer to the application, permit, and certificate numbers of a particular filing. The letter "D" in these numbers indicates the filing is a Declaration and use is claimed prior to June 6, 1945. The letter "A" indicates an application filed after that date. The term "Rejected" in the permit column or "Canc." (Cancelled) in the certificate column shows that the filing is no longer valid due to the applicant's disinterest, his failure to comply with statutory provisions, or rejection by the Division of Water Resources. The absence of a number in a column indicates that an application has not yet progressed to permit status or has not been perfected to certificate. The priority column indicates the date upon which the application was received or the date of use claimed in the case of a declaration; thus determining its priority relative to other rights which may affect or be affected by it.

The next column, "Name," refers to the name of the applicant, permittee, or original holder of the certificate, and does not necessarily refer to the present holder of the right or owner of the land. Once a certificate of water is issued, it becomes appurtenant to the land, and the Division of Water Resources does not retain records of changes of ownership.

The quantity column lists the amount of water in gallons per minute which may be withdrawn under a specific right. Quantities in parentheses are conjectural since these filings have not been perfected and are invalid.

The column, "Well Loc.," refers to the smallest recorded subdivision in which the well is located.

The column, "Use," shows the specific utilization under the right, and in the case of irrigation, lists the number of acres. The following abbreviations are used in this column.

Ac. ----------------------	Acres
Com. Dom. ---------------	Community Domestic
Dom. ---------------------	Domestic
Fire Prot. ----------------	Fire Protection
Irr. ----------------------	Irrigation

APPENDIX A

GROUND WATER RIGHTS ON RECORD WITH THE DIVISION OF WATER RESOURCES AS OF JANUARY 1, 1960

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.37N.,R.1E.			
5	A3015	2859	Canc.	2-24-53	W. T. Lockwood	(30)	Govt Lot 6	Irr. 10 Ac. & Dom.
5	A 593	589	Canc.	7-23-47	H. W. Dunn	(50)	SE SE	Irr. 38 Ac. & Dom.
					T.37N.,R.5E.			
8	A 530	511	Canc.	5-20-47	R. A. Johnson	(150)	NE SW	Irr. 28 Ac.
					T.38N.,R.1E.			
4	A2800	2563	1657A	11-3-52	Neptune Beach Water Assn.	40	Govt Lot 4	Com. Dom.
8	A4640	4365		7-5-57	James F. Bolster	100	Govt Lot 1	Com. Dom.
33	D 413		369D	1941	M. Granger	20	Govt Lot 2	Irr. 2.5 Ac. & Dom.
					T.38N.,R.2E.			
4	A3316	3302	2308A	7-29-53	H. L. Kelley	35	SE NE	Irr. 10 Ac.
6	A1054	986	1319A	1-15-49	P. Hood	130	SE SW	Irr. 40 Ac.
					T.38N.,R.4E.			
5	A4003	3727	2835A	5-12-55	Mt. Baker Water Assn. Inc.	50	Govt Lot 4	Com. Dom.
					T.38N.,R.5E.			
8	A4655	4391	3285A	8-2-57	J. Brown	150	Govt Lot 7	Irr. 60 Ac.
19	A5408	5098		9-23-59	I. Flowers	350	SE NE	Irr. 35 Ac.
29	A5030	4692	3378A	10-6-58	T. Fresla	165	NW NW	Irr. 35 Ac.
					T.39N.,R.1W.			
2	A5422	5097	3549A	10-26-59	C. W. Holeman	25	Govt Lot 4	Com. Dom.
11	A4889	4584	3474A	6-23-58	Grandview Beach Water Assn.	15	SE NW	Com. Dom.
					T.39N.,R.1E.			
1	A4940	4608	3512A	7-28-58	Custer Water Assn.	80	SW NW	Com. Dom.
1	A3222	2992	2042A	5-14-53	R. Gorze	66	SE NE	Irr. 15 Ac.
2	A3732	3487	2436A	8-10-54	Custer Water Assn.	45	SE SE	Com. Dom.
2	A4458	4205	2794A	10-10-56	Custer Water Assn.	25	SE SE	Com. Dom.
3	A3271	3252	2231A	6-15-53	Old Settlers Water Assn.	80	NE SE	Com. Dom.
3	A4550	4286	2855A	3-21-57	Old Settlers Water Assn.	16	SE SE	Com. Dom.

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.39N.,R.2E.(Continued)			
11	A 513	527	Canc.	5-2-47	A. E. Vanderyacht	(200)	NW NE	Irr. 20 Ac.
11	A4143	3911	2810A	10-24-55	A. Giger	120	NE NW	Irr. 39 Ac.
11	A2813	2595	1561A	11-12-52	H. W. Rinehart	110	SW NW	Irr. 18 Ac.
11	A2368	2168	1479A	3-3-52	J. Visser	180	SE NW	Irr. 20 Ac.
11	A2465	2285	1480A	4-24-52	G. Moldenhauer	160	S½ NE	Irr. 60 Ac.
11	A4750	4505	3377A	12-26-57	L. Strube	90	W½ SW	Irr. 18 Ac.
12	D 13		7D	6-42	G. L. Murray	110	NW NE	Irr. 38.5 Ac.
12	A2155	2022	1553A	9-26-51	G. Hickey	160	NW NW	Irr. 20 Ac.
12	A5140	4794	3409A	2-24-59	W. Wiggins	20	S½ NE	Irr. 10 Ac.
12	A3702	3496	2703A	7-15-54	T. B. Koger	50	SE NE	Irr. 5 Ac. & Dom.
12	A 704	638	Canc.	1-21-48	C. D. Albright	(45)	NE NE	Irr. 11 Ac.
12	A3478	3259	1860	1-14-54	A. V. Ellingson	75	NE SE	Irr. 20 Ac.
12	A 560	523	Canc.	6-11-47	D. O. Russell	(100)	NW SE	Irr. 15 Ac.
12	A4473	4207	2898A	11-19-56	R. Dunkin	150	NW SE	Irr. 40 Ac.
13	A4275	4068	2942A	4-5-56	E. Fleming	105	NW NE	Irr. 23 Ac.
13	A4044	3777	3068A	6-28-55	E. W. Smith	200	NE NW	Irr. 20 Ac. & Dom.
13	A4232	3985		2-27-56	E. C. Tillotson	220	NW NW	Irr. 33 Ac.
13	A2041	1884	1312A	7-23-51	H. L. Holleman	200	S½ NW	Irr. 65 Ac.
14	A4722	4447	3324A	11-4-57	R. R. Murray	96	NW SW	Irr. 40 Ac.
14	A1663	1444	811A	9-15-50	G. L. Murray	160	NW SE	Irr. 37 Ac.
14	A2173	1994	1346A	10-4-51	O. L. Mills	150	S½ SW	Irr. 27 Ac.
15	A4671	4454	3583A	9-5-57	M. Small	150	NW NE	Irr. 40 Ac.
15	A 337	323	123A	8-15-46	V. J. Desmul	250	NE SW	Irr. 20 Ac.
15	A 106	212	479A	2-1-46	D. R. Nugen	260	NW SE	Irr. 40 Ac.
15	A4470	4210	2842A	11-14-56	I. Lee	100	SE SW	Irr. 10 Ac.
17	A3160	2929	Canc.	4-13-53	A. P. Anderson	(150)	SE SE	Irr. 12 Ac.
19	A4887	4701	Canc.	6-16-58	Central City Water Assn.	(200)	Govt Lot 1	Com. Dom.
19	A2179	1982	968A	10-16-51	Meridian School Dist. #505	50	NW SW	School Dom.
19	A2509	2320	1513A	5-9-52	Town of Ferndale	1000	SW SE	Municipal Supply
19	A3899	4458	3058A	2-28-55	Town of Ferndale	870	SW SE	Municipal Supply
20	A3502	3264	2150A	2-4-54	M. Vilene	60	NW NW	Irr. 10 Ac. & Dom.
20	A 907	793	175A	6-8-48	L. C. Russell	20	SE NW	Irr. 1 Ac. & Dom.
20	A3799	3587		11-5-54	Kelley, Farquhar & Co.	750	Govt Lot 4	Industrial
20	A 941	800	Canc.	7-1-48	Whatcom-Skagit Rendering Works	(110)	NE NW	Irr. 6.84 Ac. & Industrial
22	A1249	1142	2945A	10-7-49	Greenacres Memorial Park Assn.	350	SE SE	Irr. 43 Ac.
23	A2321	2146	2395A	2-6-52	L. Megard	130	SE NE	Irr. 20 Ac.
23	A 980	911	281A	8-21-48	H. F. Puariea	7	SW SW	Irr. 5 Ac. & Dom.
24	A4748	4494		1-8-58	H. W. Anderson	160	NE NW	Irr. 20 Ac.
24	A4453	4208	3086A	10-5-56	F. Ruzicka	200	S½ NW	Irr. 35 Ac.
24	A2508	2340	1403A	5-9-52	R. L. Davenport, Jr.	130	SE NW	Irr. 20 Ac. & Stock
24	A 801	718	364A	4-6-48	G. E. Claus	150	SW SW	Irr. 70 Ac.
26	A4946	4740		7-28-58	M. C. Guitteau	1000	NE	Irr. 100 Ac.
26	A2471	2333	1204A	4-25-52	C. Erdman	180	NE SW	Irr. 20 Ac.
27	A1284	1144	416A	11-17-49	J. B. O'Neall	8	NW NE	Irr. 1 Ac. & Dom.
27	A 695	632	142A	12-31-47	E. Duncan	70	NW NE	Irr. 5 Ac.
28	A2867	2623	3417A	12-12-52	E. V. Shields	140	SW SE	Irr. 14 Ac.
28	A2470	2270	1525A	4-25-52	G. H. Slater	100	SW SE	Irr. 20 Ac.
29	A 332	264	Canc.	8-9-46	Carnation Company	(1000)	Govt Lot 2	Industrial
30	A2533	2310	1205A	4-10-52	Fertile Meadows Water Assn.	17	NE NW	Com. Dom.
30	D1125	Rejected	(in favor of A2533)		Fertile Meadows Water Assn.	(166)	NE NW	Dom.
30	A1938	1817		5-7-51	J. Manner	300	NW SE	Irr. 60 Ac. & Dom.
30	D1104		1086D	4-42	F. Imhof	50	NE SW	Irr. 2 Ac. & Dom.
30	A5412	5154		10-6-59	F. Imhof	84	NE SW	Com. Dom. & Stock
33	A3082	Rejected		3-16-53	G. Kaufman	(120)	NE NE	Irr. 25 Ac.

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.39N.,R.2E.(Continued)			
34	A3681	3486	2130A	6-21-54	N. W. Water Assn. Inc.	30	NW NW	Com. Dom.
34	D1114		1046D	1-18-52	M. A. Gilmour	100	SW SW	Irr. & Dom.
35	A2775	2542		10-23-52	A. E. Hansen	200	NW NE	Irr. 20 Ac. & Dom.
35	A2835	2614	Canc.	11-28-52	J. C. Smith	(100)	SW NW	Irr. 10 Ac.
35	A4349	Rejected		6-12-56	A. E. Boyd	(400)	SE SW	Irr. 40 Ac.
36	A 266	261	988A	6-6-46	C. V. Wilder	450	E½	Irr. 50 Ac. & Com. Dom.
36	A5011	4811		9-18-58	C. V. Wilder	400	W½ SE	Irr. 40 Ac.
					T.39N.,R.3E.			
1	*A 518	491	230A	5-7-47	C. Walsh & T. J. Walsh	160	NE NE	Irr. 20.5 Ac.
1	A5169	4830		3-17-59	E. Singer	200	S½ SW	Irr. 30 Ac.
2	A3784	3641	2313A	10-18-54	Shookum Chuck Water Assn.	240	Govt Lot 2	Com. Dom.
2	A1428	1241	950A	3-23-50	T. R. Bailey	160	Govt Lot 2	Irr. 9 Ac.
2	A1041	Rejected		12-8-48	R. Schafer	(200)	NE NW	Irr. 80 Ac.
2	A 437	400		1-22-47	W. F. Hubbard	200	NE SW	Irr. 40 Ac.
2	A3671	3394	2331A	6-11-54	C. McBride	60	SW SW	Irr. 10 Ac.
2	A 256	206	176A	5-25-46	W. F. Hubbard	65	SE SW	Irr. 2.5 Ac.
3	A2549	2392	2068A	5-23-52	S. Vander Veen	160	NE SE	Irr. 30 Ac.
3	A2143	1979	1171A	9-19-51	H. J. Koppelman	85	SW SW	Irr. 20 Ac.
3	A 483	429	1040A	3-18-47	E. Knutzen	250	S½ S½	Irr. 40 Ac.
4	A3220	2909	1903A	5-14-53	A. J. Chilton	150	SW SW	Irr. 15 Ac.
4	A3167	2868	1946A	4-14-53	M. Cowen	160	E½ SW	Irr. 20 Ac.
4	A 366	311	42A	9-14-46	J. W. Bookey	150	SW SE	Irr. 20 Ac.
4	A1581	1373	943A	7-7-50	J. R. Goodman	50	SE SE	Irr. 8 Ac.
5	A 993	881	362A	9-13-48	R. E. McGhee	28	NE NW	Dom. & Irr.
5	A2539	2357	1364A	5-19-52	F. P. Maneval	150	NE SE	Irr. 15 Ac.
5	A2355	2182	1095A	2-25-52	H. B. Benedict	126	NE SW	Irr. 25 Ac.
5	A3184	2937	1907A	4-24-53	P. A. Norris	200	SW SW	Irr. 40 Ac.
5	A2356	2189	2016A	2-21-52	B. Benson	100	SW SE	Irr. 12 Ac.
5	A4057	3790	2457A	7-11-55	J. S. Sawyer	50	SE SE	Irr. 5 Ac.
5	A4059	3792	2416A	7-11-55	D. J. Arthur	42	SE SE	Irr. 4 Ac.
6	A1145	1069	448A	6-18-49	J. Jansen	50	Govt Lot 5	Irr. 5 Ac. & Dom.
6	A2448	2242	1414A	4-14-52	E. L. Stieber	140	N½ SW	Irr. 10 Ac.
6	A3663	3388	Canc.	6-4-54	W. J. Edwards	(80)	Govt Lot 7	Irr. 8 Ac.
6	A3209	2972	2029A	5-11-53	H. Tjoelker	80	SE SW	Irr. 9 Ac.
6	A3053	2907	1983A	3-9-53	W. J. Van Etten	60	SE SW	Irr. 10 Ac.
6	A2451	2248	1766A	4-17-52	C. A. Hillebrecht	150	SW SE	Irr. 20 Ac.
6	A1573	1353	534A	6-26-50	J. DeYoung	120	SE	Irr. 30 Ac.
6	A3690	3463	2385A	6-28-54	M. Burgraff	150	SE SE	Irr. 20 Ac.
7	A3715	3456	2632A	7-26-54	O. W. Blanton	50	Govt Lot 2	Irr. 8 Ac. & Dom.
7	A4601	4322	3109A	5-6-57	M. W. Door	75	SE NW	Irr. 9 Ac.
7	A3365	3174	1779A	9-3-53	S. H. Sleeth	60	SE NW	Irr. 6 Ac. & Fire Prot.
7	A1191	Rejected		8-4-49	W. & J. Kehl	(1000)	NW SE	Irr. 15 Ac.
7	A3486	3260	3284A	1-21-54	M. W. Armstrong	190	Govt Lot 3	Irr. 60 Ac.
7	A3294	3051	2363A	7-2-53	B. McPherson	210	SE SW	Irr. 40 Ac.
8	A 104	73	10A	1-28-46	J. C. Dyke	200	NE NE	Irr. 20 Ac.
8	A2878	2759	1873A	12-26-52	G. G. Sharp	100	NE NW	Irr. 18 Ac.
8	A 795	742	2918A	4-3-48	R. Haugen	150	NW NW	Irr. 20 Ac.
8	A 921	1109	1320A	5-29-48	A. Hammill	125	NW NW	Irr. 17 Ac.
9	A2859	2637	1815A	12-11-52	N. L. Honcoop, Sr.	200	W½ NE	Irr. 60 Ac.
9	A3404	3175	1951A	10-15-53	G. H. Helmsing	150	NW NW	Irr. 18 Ac.
9	A 302	257	390A	7-5-46	A. J. Chilton	200	NW NW	Irr. 17 Ac.
9	A 912	919	407A	6-9-48	C. I. Forbes	250	W½ SE	Irr. 10 Ac., Dom. & Stock
9	A 311	271	264A	7-22-46	L. Weaver	200	E½ SW	Irr. 40 Ac.
9	A 394	370	251A	11-7-46	L. Weaver	200	SE SW	Irr. 20 Ac.
9	A3617	3492	2386A	5-13-54	R. Gienger	100	SW SE	Irr. 40 Ac.

*Certificate in error--change required

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.39N.,R.3E. (Continued)			
10	A 257	Rejected		5-27-46	Lunde Brothers	(200)	NE SW	Irr. 40 Ac.
10	A 376	314	527A	9-24-46	L. Broersma	140	SW SW	Irr. 20 Ac.
11	A1432	1395	766A	3-27-50	W. Kok	110	NE NW	Irr. 19 Ac.
11	D 193		151D	5-15-45	C. Guckert	20	NW NW	Irr. 1 Ac.
11	A1494	1299	508A	4-28-50	W. Munkres	180	SW NW	Irr. 35 Ac.
11	A4380	4090	Canc.	6-11-56	P. Tjoelker	(270)	NW SW	Irr. 60 Ac.
12	A1952	1780	725A	5-14-51	A. C. Brue	300	SE SE	Irr. 19.25 Ac.
16	A 118	150	2712A	2-1-46	J. W. Boerhave	360	NE NE	Irr. 40 Ac.
16	A 125	151	106A	2-19-46	J. W. Boerhave	300	NW NE	Irr. 30 Ac.
16	A 911	801	417A	6-9-48	S. Sooter	250	NE NW	Irr. 10 Ac., Dom. & Stock
16	A 117	149	Canc.	2-1-46	J. W. Boerhave	(300)	NE NW	Irr. 10 Ac.
16	A1469	1348	506A	4-15-50	R. Georgeff	70	NW NW	Irr. 8 Ac.
16	A2505	2300	1845A	5-8-52	P. Zuidmeer	180	SW NW	Irr. 30 Ac.
16	A4184	3942	2776A	12-19-55	H. Miller	160	SW NE	Irr. 40 Ac.
16	A3436	3214	Canc.	11-20-53	G. Trapeur	(120)	NE SW	Irr. 20 Ac.
17	A5212	4885		4-15-59	H. Sterk	250	NW NW	Irr. 60 Ac.
17	A 663	600	749A	11-13-47	R. Halderman	160	NE SE	Irr. 29 Ac.
17	A2445	2257	1160A	4-11-52	M. P. Anderson	80	SE SW	Irr. 8 Ac.
18	A3788	3590	2253A	10-21-54	Guide Meridian Water Assn.	120	NW NW	Group Dom. & Farm
18	A 541	512	373A	5-26-47	W. S. DeLong	140	SE NE	Irr. 20 Ac.
18	*D 819		782D	4-1-45	H. S. Cole	60	NW SW	Irr. 30 Ac.
19	A2179	1982	968A	10-16-51	Meridian School Dist. #505	50	NW SW	School Supply
19	A1430	1271	1433A	3-23-50	C. V. Wilder	200	SE SE	Industrial
20	A2261	Rejected		12-17-51	H. Mans	(224)	SE NE	Irr. 35 Ac.
24	A4472	4211	3156A	7-17-56	G. Haggith	210	SW NW	Irr. 50 Ac.
32	D 501		438D	8-10-37	Smith Road Coop. W. Assn.	20	NW NW	Com. Dom.
33	A2007	1849	1467A	6-18-51	Victor Water Assn.	40	W½ NW	Com. Dom.
					T.39N.,R.4E.			
3	A 473	419	Canc.	3-7-47	C. Pinkey	(250)	SW SW	Irr. 40 Ac.
5	A1769	1595	1634A	12-29-50	E. Terpsma	250	Govt Lot 2	Irr. 28 Ac.
5	A2108	1934	1864A	8-29-51	H. Pulley	60	SE SW	Irr. 10 Ac.
5	A4602	4323	2905A	5-8-57	T. Dean	91	SE SW	Irr. 25 Ac.
5	A2366	2205	2148A	2-28-52	J. A. Vossbeck	120	SW SE	Irr. 30 Ac.
6	A 579	506	350A	7-7-47	J. W. Lyon	250	NW NW	Irr. 51 Ac.
8	A1868	1727	2460A	5-16-51	Flotre Brothers	320	S½ N½ & SW SE	Irr. 150 Ac.
8	A1919	1778	1170A	4-24-51	O. K. Thompson	128	NW SE	Irr. 20 Ac.
8	A3517	3274	2488A	2-19-54	H. L. Jacobson	100	NW SE	Irr. 8 Ac.
8	A2296	2101	1048A	1-14-52	T. R. Kvamme	160	E½ SE	Irr. 50 Ac.
9	A 986	865	644A	8-30-48	C. Greenfield	100	SE NW	Irr. 6 Ac.
9	A2431	2342	Canc.	4-4-52	E. O'Cain	(200)	S½ NE	Irr. 60 Ac.
9	A1985	1863	1217A	5-31-51	L. Neevel	200	SW SW	Irr. 20 Ac.
9	A4167	3956	3051A	11-29-55	T. W. Betts	120	SE SW	Irr. 16 Ac.
9	A3050	2958	2552A	3-9-53	F. J. Theel	150	SW SE	Irr. 15 Ac.
9	A4122	3873	Canc.	9-23-55	H. Helgesen	(320)	E½ SE	Irr. 60 Ac.
16	A2974	2723		2-6-53	A. Neyhart	150	NW NE	Irr. 25 Ac.
16	A5148	4795		3-2-59	R. R. Bengen	180	NW	Irr. 40 Ac.
16	A1886	1772	1142A	3-27-51	A. R. Bruland	200	NW SE	Irr. 17 Ac.
16	A1595	1381	545A	7-6-50	W. F. Richards	100	NE SE	Irr. 12 Ac.
16	A1779	1656	1147A	1-15-51	R. R. Bengen	200	NE SW	Irr. 40 Ac.
16	A4894	4671		6-20-58	L. E. Kosa	200	SW SW	Irr. 34 Ac.
16	A1295	1155	455A	12-7-49	W. F. Richards	140	SW SE	Irr. 15 Ac.

*Certificate in error--change required

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.39N.,R.4E. (Continued)			
16	A4875	4709		6-2-58	G. Aase	200	SE SE	Irr. 25 Ac.
16 & 17	A3480	3381	2342A	1-15-54	D. Hoines	200	NW NW 16 NE NE 17	Irr. 84 Ac.
19	A2494	2298	Canc.	5-5-52	R. Suchy	(100)	NE SE	Irr. 10 Ac. & Dom.
20	A3062	2941	Canc.	3-11-53	T. M. Sather	(250)	Govt Lot 4	Irr. 40 Ac.
20	A3720	3461	2692A	7-30-54	M. R. McElvain	150	NW SW	Irr. 32 Ac.
21	A4978	4755		8-27-58	L. Fullner	200	NW NE	Irr. 43 Ac.
21	A1923	1755	1037A	4-26-51	M. Harmoney	112	NE SE	Irr. 19.67 Ac.
21	A 163	108	294A	3-6-46	H. C. Blickenstaff	80	NE SE	Irr. 12 Ac.
22	A 512	456	911A	4-29-47	R. Spaulding	100	NW SW	Irr. 6 Ac.
22	A 227	222	Canc.	5-2-46	A. Reed	(80)	NW SW	Irr. 6 Ac.
26	A 148	94	225A	2-25-46	W. A. Robson	200	NE SE	Irr. 30 Ac.
26, 27 & 34	A3422	Rejected		11-5-53	L. H. & M. B. Thompson	(380)	Govt Lot 3-26 Govt Lot 7-27 Govt Lot 1-34	Irr. & Stock
27	A2138	1974	1636A	9-14-51	A. G. Larson	100	NE NW	Irr. 20 Ac.
27	A3102	2894	Canc.	3-23-53	T. Aarstol	(150)	NE NW	Irr. 15 Ac.
27	A3488	3269	2611A	1-22-54	S. A. MacDonald	200	S½ NW	Irr. 20 Ac.
27	A4068	3802	3084A	6-15-55	A. C. Monsen	100	NE SE	Irr. 34 Ac.
27	A2315	2138	1966A	2-4-52	G. A. Roemer	75	SE NE	Irr. 7.5 Ac.
31	A 864	807	873A	5-19-48	R. W. Carbee	200	SE SE	Irr. 15 Ac. & Dom.
					T.39N.,R.5E.			
21	A2953	2691	1483A	1-27-53	H. M. Ingersoll	120	SE SE	Irr. 20 Ac. & Dom.
27	A1662	1437	Canc.	9-15-50	J. Kramer	(200)	SW NE	Irr. 40 Ac.
					T.40N.,R.3W.			
11	A3693	3443	2399A	7-1-54	J. F. Waters	8	Govt Lot 2	Com. Dom.
					T.40N.,R.1E.			
1	A4131	3931	2748A	10-6-55	"H" St. Water Assn. Inc.	6	SE NE	Com. Dom.
3	A5086	4815		12-22-58	City of Blaine	750	NW SW	Municipal Supply
14	A3543	3396	2390A	2-15-54	J. Svedin	130	NW SW	Irr. 30 Ac.
17	A3538	3511		3-12-54	W. R. Loop	150	SE NE	Irr. 15 Ac. & Dom.
21	A2181	1996	1507A	10-17-51	P. E. Holtzheimer	170	NW SW	Irr. 17 Ac.
21	A4467	4385	3234A	11-5-56	P. Hansen	40	NW SW	Irr. 8 Ac. & Dom.
22	A2584	2371	1637A	6-6-52	L. K. Breidford	80	NW NW	Irr. 16 Ac.
22	A3304	3045	Canc.	7-17-53	L. F. Holtzheimer	(200)	SW NW	Irr. 20 Ac.
22	A2860	2622	1791A	12-11-52	S. A. Rosin	50	SW SE	Irr. 4 Ac.
24	A2507	2381	Canc.	5-9-52	J. J. Kliewer	(150)	SW NE	Irr. 40 Ac.
24	A3351	3178	2104A	8-28-53	A. Mohr	40	NE SE	Irr. 4 Ac.
24	A1853	1731	927A	3-3-51	S. Smith	200	N½ SE	Irr. 40 Ac.
24	A2795	2643	2232A	10-30-52	G. E. Hoagland	150	SE SW	Irr. 25 Ac.
25	A2723	2521	Canc.	9-22-52	J. T. Pemberton	(200)	NW SW	Irr. 20 Ac.
26	A 467	434	975A	3-1-47	N. P. Hardman	160	NE SW	Irr. 20 Ac.
26	A 450	408		1-29-47	W. L. Hawkins	300	SE SE	Irr. 35 Ac.
26	A 449	407		1-29-47	W. L. Hawkins	300	SE SE	Irr. 35 Ac.

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.40N.,R.1E. (Continued)			
27	A5164	4884		3-16-59	W. Wilder	175	S½ NE	Irr. 73 Ac.
31	A1427	1270	666A	3-23-50	Seattle Dist. Corps of Engrs.	30	NW SE	Dom.
35	D 184 (Certificate of Change 619)		112D	7-35	G. R. Pettit	28	SW NE	Irr. 2.5 Ac.
35	A 178 (Certificate of Change 619)	138	477A	3-14-46	G. R. Pettit	100	SW NE	Irr. 7 Ac. & Dom.
35	A2809	2620	Canc.	11-7-52	E. McNallie	(400)	SE NW	Irr. 40 Ac.
35	A3505	3265	2146A	2-8-54	G. R. Pettit	7	SW NE	Irr. 8 Ac.
					T.40N.,R.2E.			
1	A4000	3764	2492A	5-10-55	F. Rehm	260	Govt Lot 2	Irr. 40 Ac.
1	A4612	4411	3309A	5-20-57	H. L. Holleman	120	SE NW	Irr. 35 Ac.
1	A4369	4097	2949A	6-29-56	H. A. Rutgers	120	NW SW	Irr. 40 Ac.
1	A3089	2964	2010A	3-18-53	R. Van Mersbergen, Sr.	150	SE SW	Irr. 40 Ac.
2	A1786	1605	830A	1-18-51	J. Axling	180	NE SE	Irr. 34 Ac.
2	A4508	4328	3229A	1-28-57	J. H. Van Dalen	200	SW SW	Irr. 20 Ac.
2	A2400	2292	1325A	3-21-52	J. H. Van Dalen	200	SW SE	Irr. 40 Ac.
8	A3609	2943	Canc.	3-12-53	L. Goodman	(180)	E½ SW	Irr. 40 Ac.
10	A3352	3227	1934A	8-28-53	J. Reimer, Jr.	180	SW SW	Irr. 30 Ac.
10	A4802	4536	3254A	3-7-58	V.M. Hoffman	160	W½ SW	Irr. 40 Ac.
10	A2745	2607	1687A	10-8-52	R. Vander Werff	150	NE SE	Irr. 20 Ac.
11	A3550	Rejected		3-22-54	J. Tolsma	(180)	NE NW	Irr. 50 Ac.
11	A3607	3355	1937A	5-10-54	G. Schoessler, Jr.	200	SW NW	Irr. 36 Ac.
11	A2393	2275	1559A	3-17-52	J. Helgath	225	SW NE	Irr. 35 Ac.
11	A2348	2172	1349A	2-20-52	I. I. Vanderyacht	225	NW SE	Irr. 35 Ac.
11	A3208	2934	1947A	5-11-53	J. Den Beston	110	NW SW	Irr. 30 Ac.
12	A2318	2131	1473A	2-5-52	L. De Jong	150	NE NE	Irr. 30 Ac.
12	A5286	5007		6-8-59	D. Bajema	180	NE NW	Irr. 30 Ac.
12	A2435	2262	1220A	4-7-52	B. Korthuis	130	SE NW	Irr. 15 Ac.
12	A2221	2047	1955A	11-16-51	B. Hendricks	180	NE SE	Irr. 60 Ac.
13	A1657	1564	1045A	9-9-50	H. Vander Griend	150	NE NE	Irr. 18 Ac.
13	A2864	2648	2910A	12-12-52	A. Schouten	240	E½ NW	Irr. 45 Ac.
13	A3134	2913	1622A	3-30-53	G. Bedlington	150	SW NW	Irr. 15 Ac.
13	A5242	4972		5-8-59	C. M. Vander Griend	160	SE NE	Irr. 40 Ac.
13	A1198	1133	757A	8-10-49	H. B. Crabtree	160	SW SE	Irr. 40 Ac.
14	A3622	3354	3262A	5-17-54	M. Cowin	72	SW SW	Irr. 60 Ac.
15	A3087	2912	1621A	3-18-53	G. Bedlington	180	NE NE	Irr. 39 Ac.
15	A 463	409	882A	2-27-47	H. O. Worthen	250	SE NE	Irr. 12.5 Ac.
15	A 161	111	1162A	3-5-46	O. L. Vineyard & Son	300	SE NE	Irr. 24 Ac.
15	A 162	112	1161A	3-5-46	O. L. Vineyard & Son	300	E½ SW	Irr. 80 Ac.
15	A3723	3506	Canc.	8-5-54	V. Menser	(100)	SW SE	Irr. 19 Ac.
15	A 668	1825	1206A	11-15-47	C. T. McClelland	70	SE SE	Irr. 20 Ac.
16	A3128	2863	1540A	3-27-53	M. Bostwick	110	NE NE	Irr. 40 Ac.
16	A4475	4263		11-21-56	H. Remington	150	W½ SW	Irr. 69.32 Ac.
17	A 533	Rejected		5-17-47	T. Skidmore	(250)	NE NE	Irr. 20 Ac.
17	A 534	Rejected		5-17-47	T. Skidmore	(250)	SE NE	Irr. 40 Ac.
17	A3687	3475	2109A	6-23-54	V. L. Brewer	160	SW SE	Irr. 40 Ac.
18	A4094	3849	2737A	8-29-55	E. A. Sawyer	120	Govt Lot 1	Irr. 22 Ac.
19	A5185	4850	3448A	3-27-59	J. Erickson	50	NE SE	Irr. 25 Ac.
19	A3747	3480	2709A	8-30-54	H. N. Hanson	144	SE SW	Irr. 29 Ac.
20	A 496	432	Canc.	4-1-47	L. E. Maberry	(160)	NE NE	Irr. 40 Ac.
20	A2921	2654	1785A	1-14-53	R. Slagle	180	NW NE	Irr. 37 Ac.
20	A2918	2685	2041A	1-13-53	E. Jansen	150	SE NE	Irr. 40 Ac.
20	A2960	2729	2127A	1-29-53	H. G. James	160	NE SE	Irr. 40 Ac.

T.40N.,R.2E.(Continued)

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
20	A3060	2999	Canc.	3-11-53	A. A. Bauman	(180)	SW SE	Irr. 40 Ac.
20	A3094	2881	2452A	3-19-53	A. A. Bauman	150	SW SE	Irr. 20 Ac.
22	A3189	Rejected		4-29-53	W. E. Holt	(200)	SE NE	Irr. 64.44 Ac.
22	A1973	1846	1234A	5-23-51	R. F. Rawls	75	SW SW	Irr. 7.50 Ac.
22	A2351	2162	1300A	2-21-52	L. E. Maberry	320	SW SE	Irr. 70 Ac.
23	A 929	802	866A	6-19-48	L. J. Derr	160	SW NE	Irr. 32 Ac.
23	A5151	4807		3-3-59	R. C. Bajema	175	NE SE	Irr. 70 Ac.
23	A2185	2002	1237A	10-24-51	J. S. Sawyer	70	SW SE	Irr. 10 Ac.
23	A3266	3022	2178A	6-11-53	J. P. Verduin	100	SW SE	Irr. 10 Ac.
23	A2942	2686	1438A	1-26-53	M. Clark	150	SW SE	Irr. 20 Ac.
23	A 443	406	789A	1-30-47	I. P. Fassett	160	SE SE	Irr. 36 Ac.
24	A4400	4178	2787A	8-13-56	G. Vermeulen	120	SE NW	Irr. 40 Ac.
24	*A 796	732	200A	4-5-48	E. G. Pierce	200	SW NE	Irr. 40 Ac.
24	A 393	338	501A	10-30-46	P. Geleynse	200	SW SW	Irr. 35 Ac.
24	A2419	2239	1618A	3-31-52	A. Crabtree	120	NE NW	Irr. 60 Ac.
24	A2492	2280	1512A	5-5-52	P. Geleynse	150	W½ SW	Irr. 20 Ac.
25	D 239		228D	6-1-44	C. Graves	75	NW NW	Irr. 4 Ac. & Dom.
25	A3173	2905	1930A	4-20-53	M. A. Coleman	150	NW NW	Irr. 20 Ac.
26	A3568	3364	2312A	4-5-54	J. T. Williams	130	NE NE	Irr. 15 Ac.
26	A1789	1668	1388A	1-23-51	J. Terpsma	200	W½ NE	Irr. 40 Ac.
26	A 365	315	906A	9-13-46	J. Ramerman	300	NE NW	Irr. 15 Ac.
26	A2696	2473	1853A	9-5-52	H. Smit	150	NE NW	Irr. 18 Ac.
26	A2335	2174	1410A	2-13-52	E. L. Harlow	120	NW NW	Irr. 10 Ac.
27	A3241	2977	1976A	5-27-53	M. H. Jensen	150	NW SW	Irr. 40 Ac. & Dom.
27	A3242	2978	1977A	5-27-53	M. H. Jensen	150	SW SW	Irr. 40 Ac. & Dom.
28	A4014	3841	2455A	5-25-55	C. Bedell	130	NE NE	Irr. 20 Ac.
28	A4024	3771	3075A	5-31-55	E. J. Claxton	200	NW NE	Irr. 38.74 Ac.
28	A1798	1618	2831A	1-31-51	J. L. Monohan	120	N½ SE	Irr. 30 Ac.
29	A1817	1677	1089A	2-6-51	R. W. McGowan	300	E½ NE	Irr. 40 Ac.
29	A3095	3001	2209A	3-19-53	O. E. Wilson	200	E½ SE	Irr. 80 Ac.
31	A3591	3349	1979A	4-22-54	L. Bainter	180	SE NW	Irr. 20 Ac.
31	A3043	2762	1838A	3-6-53	G. Rust	150	E½ NW	Irr. 25 Ac.
31	A2271	2084	1426A	12-24-51	E. Veldhuizen	130	NE SE	Irr. 33 Ac.
32	A1951	1857	948A	5-14-51	H. Potts	200	SW SE	Irr. 35 Ac.
33	A5161	4839	3442A	3-11-59	C. J. Wilson	150	NW	Irr. 40 Ac.
33	A2312	Rejected		1-31-52	C. Wilson	(300)	N½ NW	Irr. 100 Ac.
33	A 510	453	Canc.	4-22-47	H.L. Pettibone & U.D. Jones	(150)	SE SW	Irr. 20 Ac.
34	A4276	4053	3017A	4-5-56	H. Terpsma	90	NE NW	Irr. 20 Ac.
34	A1171	1064	Canc.	7-16-49	R. S. Ellis	(200)	NW NW	Irr. 40 Ac. & Dom.
34	A4353	4057	2670A	6-13-56	V. B. Ritter	180	Govt Lot 5	Irr. 40 Ac.
35	A 891	823	837A	6-4-48	B. O. Viddal	120	Govt Lot 2	Irr. 26 Ac.
36	A5247	4936		5-11-59	J. Larson	100	SE SW	Irr. 10 Ac.

T.40N.,R.3E.

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
1	A 474	431	244A	3-11-47	C. Kooi	250	NE NE	Irr. 40 Ac.
1	A 519	539	2078A	5-7-47	R. W. Hendrik	100	NE SW	Irr. 10 Ac.
1	A5111	4802		1-23-59	H. A. Ehlers	200	SE SE	Irr. 71 Ac.
1	A3221	3054	2115A	5-14-53	R. A. Marchant	180	SW SE	Irr. 40 Ac.
2	A1808	1659	1031A	2-5-51	F. Ondeck	160	NW NE	Irr. 60 Ac.
2	A2295	2094	Canc.	1-14-52	J. Ondeck	150	SE NE	Irr. 20 Ac.
2	A4437	4159	3139A	9-17-56	H. Nieuwsma	250	NW SW	Irr. 25 Ac. & Stock
2	A 259	256	226A	6-1-46	A. C. Bauman	120	SW SW	Irr. 30 Ac.
2	A1066	1017	972A	2-10-49	L. Kraght	160	SE SE	Irr. 40 Ac.

*Certificate in error--change required

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.40N.,R.3E.(Continued)			
2	A4992	4736		9-8-58	Pangborn Water Assn.	30	SE SE	Com. Dom.
3	A3322	3197	2185A	8-4-53	A. E. Johnson	240	SE NW	Irr. 120 Ac.
3	A1795	1643	751A	1-25-51	A. Schoessler	175	W½ NE	Irr. 76 Ac.
3	A3229	2973	1931A	5-20-53	C. Snider	180	N½ SE	Irr. 40 Ac.
3	A 520	464	1247A	5-9-47	S. Bajema	165	N½ SE	Irr. 30 Ac.
3	A1816	1676	1069A	2-6-51	A. P. Brandt	275	SE SW	Irr. 60 Ac.
3	A3534	4342	3276A	3-11-54	A. P. Brandt	200	SE SW & SW SE	Irr. 45 Ac.
3	A1633	1590	Canc.	8-22-50	C. A. Frazier	(150)	SE SE	Irr. 10 Ac.
5	A3512	3291	2685A	2-15-54	A. De Haan	120	Govt Lot 4	Irr. 36 Ac.
5	A4104	3831	2717A	9-8-55	R. De Motts	180	NW SW	Irr. 48 Ac.
6	A3230	3011	3487A	5-21-53	C. Eshuis	250	SE NE	Irr. 35 Ac.
6	A4045	3824	2778A	6-28-55	J. Rietman	200	Govt Lot 4	Irr. 38 Ac.
6	A3904	3743	2634A	3-7-55	A. Hovander	120	NW NE	Irr. 40 Ac.
6	A5249	4891	3445A	5-11-59	B. Statema	180	E½ SW	Irr. 70 Ac.
	(Certificate of Change 614)							
6	A4496	4214	2905A	1-15-57	F. Dykman	150	Govt Lot 4	Irr. 39 Ac.
7	A5226	4907		4-24-59	J. Rupke	350	SW NE	Irr. 35 Ac.
7	D 970		735D	7-20-41	A. R. Benson	250	NE NE	Irr. 70 Ac.
8	A2476	2318	1629A	4-28-52	S. Holloman	225	W½ SW	Irr. 30 Ac.
8	A4354	4050	2671A	6-15-56	F. Otter	180	NE SE	Irr. 40 Ac.
9	A3716	3457	2062A	7-26-54	R. Nonhoff	300	NE NE	Irr. 40 Ac.
9	A3731	3469	2418A	8-10-54	Delta Water Assn.	200	SE SE	Com. Dom.
10	D 391		320D	7-44	K. F. Stallard	120	NE NW	Irr. 20 Ac.
10	A2118	1947	1314A	9-4-51	L. E. Bradley	180	NE SE	Irr. 39 Ac.
10	A2320	2132	1510A	2-6-52	O. O. Olin & Son	40	SE SE	Irr. 4 Ac.
11	A2224	2040	1396A	11-16-51	J. Lagerway	140	SW NW	Irr. 20 Ac.
11	A3554	3368	2318A	3-24-54	F. M. & G. Harvey	200	SE NW	Irr. 60 Ac.
14	A2843	2576	2114A	12-4-52	Northwood Water Assn.	70	NW NW	Com. Dom. & Stock
15	A4608	4324	2917A	5-14-57	L. H. Hersman	50	NW NE	Irr. 8 Ac.
15	A 592	579	1248A	7-23-47	J. Husfloen	100	NE NW	Irr. 10 Ac.
15	A4347	4069	2972A	6-11-56	E. Roo	150	NE NW	Irr. 20 Ac.
15	A3555	3362	2330A	3-25-54	B. E. Shea	180	SW NW	Irr. 35 Ac.
15	A3624	3399	2375A	5-17-54	C. A. Frazier	180	SW NE	Irr. 19 Ac.
15	A3592	3338	2519A	4-23-54	Meadowdale Water Assn.	150	NE SW	Com. Dom.
15	A 151	141		2-26-46	C. V. Wilder	600	NW SW	Irr. 40 Ac. & Dom.
16	A3526	3382	2013A	3-2-54	R. De Motts	130	SW NW	Irr. 28 Ac.
16	A 284	244	Canc.	6-22-46	L. F. Piercey	(150)	SW NE	Irr. 20 Ac.
16	A 543	517	641A	5-27-47	R. Stouffer & V. B. Tripp	80	NE SE	Irr. 35 Ac.
16	A3342	3206	Canc.	8-19-53	C. H. Hersman	(70)	SW SW	Irr. 7 Ac.
16	A3141	2969	2504A	4-2-53	I. Geleynse	150	SE SW	Irr. 18 Ac.
16	A1654	1435	Canc.	9-8-50	W. L. Dodson	(160)	SW SE	Irr. 40 Ac.
17	A1604	1495	933A	7-26-50	D. De Young	160	NE	Irr. 20 Ac.
17	A2139	1993	1315A	9-14-51	W. Heusinkveld	180	SW NW	Irr. 40 Ac.
17	A1620	1411	532A	8-4-50	T. J. Bay	100	SW SW	Irr. 60 Ac.
18	A4549	4297	2859A	3-13-57	N. G. Brand	150	Govt Lot 1	Irr. 35 Ac.
18	A4027	3754	2577A	6-2-55	H. Plageman	150	Govt Lot 2	Irr. 18 Ac.
18	A5139	4792		2-20-59	T. J. Bay	165	SE SE	Irr. 40 Ac.
18	A5257	4997		5-20-59	H. Heusinkveld, Jr.	350	SE NE	Irr. 35 Ac.
18	A2562	2566	1697A	5-28-52	P. Weg, Sr.	150	NW SE	Irr. 40 Ac.
18	A2510	2366	1343A	5-9-52	G. E. Meenderinck	180	W½ SW	Irr. 40 Ac.
19	A3254	3058	1804A	6-4-53	R. Taylor	120	SW NE	Irr. 10 Ac.
20	A2382	2184	Canc.	3-10-52	J. Harkoff	(200)	NW NE	Industrial
21	A2251	2068	1261A	12-10-51	E. J. Scholten	180	S½ NE	Irr. 46 Ac.
21	A4357	Rejected		6-15-56	F. E. Landaal	(100)	SW NW	Irr. 7 Ac.

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.40N.,R.3E.(Continued)			
22	A3122	3155	Canc.	3-26-53	W. Lankhaar	(180)	NW SE	Irr. 20 Ac.
22 & 23	A2937	2746	2458A	1-20-53	G. Lankhaar	150	SE SE-22 SW SW-23	Irr. 38 Ac.
23	A3186	3093	2269A	4-28-53	D. Feller	150	SE NW	Irr. 20 Ac.
23	A3080	2893		3-16-53	H. Slotemaker	180	NE SW	Irr. 30 Ac.
23	A2652	2470	1653A	7-25-52	D. Slotemaker	150	SE SW	Irr. 28 Ac.
23 & 26	A3264	3116	2549A	6-9-53	S. S. Jeffcott	120	SE SE-23 NE NE-26	Irr. 28 Ac. & Stock
25	A4609	4344	2958A	5-17-57	T. Roorda	135	W½ SE	Irr. 40 Ac.
26	A2528	2397	1443A	5-15-52	J. L. Mulder	180	NE NW	Irr. 38 Ac.
26	A2149	2016	1395A	9-24-51	H. Scholten	180	NW NE	Irr. 56 Ac.
26	A3708	3453	2384A	7-21-54	N. Roosendaal	150	SW NE	Irr. 25 Ac.
26	A4649	4370	3129A	7-23-57	G. Vander Mey	140	SE NE	Irr. 35 Ac.
26	A3725	3515	2442A	7-28-54	B. Vande Kamp	250	Govt Lot 5	Irr. 32 Ac.
27	A 868	764	376A	5-15-48	T. & G. Honcoop	150	NE NE	Irr. 37 Ac.
27	A2841	2625	Canc.	12-2-52	L. M. Lankhaar	(150)	Govt Lot 1	Irr. 40 Ac.
27	A2823	2613	1417A	11-24-52	J. T. De Jong	150	SW NW	Irr. 15 Ac.
27	A3582	3370	2160A	4-15-54	O. C. Noteboom	150	NE SW	Irr. 30 Ac.
27	A2496	2354	Canc.	5-5-52	J. T. De Jong	(180)	SW SW	Irr. 40 Ac.
28	A2327	2158	2067A	2-8-52	K. Polinder	250	NW NE	Irr. 40 Ac.
28	A5168	4944		3-17-59	C. M. & M. Huisman	180	SE NE	Irr. 18 Ac.
30	A4286	4040	2711A	4-19-56	G. T. Bode	200	E½ NE	Irr. 30 Ac.
31	A 229	207	346A	5-7-46	N. J. D. McLeod	125	SE SW	Irr. 15 Ac.
32	A3012	2754	1464A	2-20-53	C. Wagner	120	NE SE	Irr. 18 Ac.
32	A1891 (Certificate of Change 615)	1753	1215A	3-31-51	H. Dykstra	180	NW SW	Irr. 40 Ac.
32	A 237	196	290A	5-14-46	J. Hollander	110	SE SE	Irr. 16 Ac. & Dairy
32	A5167	4945		3-17-59	C. M. & M. Huisman	100	SW NE	Irr. 10 Ac.
33	A2343	2171	1378A	2-18-52	J. F. Oltman	100	SE SW	Irr. 30 Ac.
33	A2301	2211	1626A	1-22-52	H. Boehringer	180	SW SE	Irr. 40 Ac.
33 & 34	A4237	Rejected		3-6-56	P. Van Dyk, Sr.	(250)		Irr.
34	A3088	2945	2397A	3-18-53	H. Bosman	150	SW NW	Irr. 35 Ac.
34	A4238	4165	3077A	3-6-56	P. Van Dyk, Sr.	250	SE NW	Irr. 30 Ac.
34	A 212	157	61A	4-12-46	A. J. Chilton	175	NE SE	Irr. 60 Ac.
35	A 246	198	Canc.	5-21-46	D. Bouwman	(200)	NE SW	Irr. 20 Ac.
36	A 153	148	Canc.	2-28-46	W. Pride	(70)	SE NE	Irr. 10 Ac.
36	D 492 (Certificate of Change 587)		403D	1935	Town of Everson	350	NE SE	Municipal Supply
36	D 493 (Certificate of Change 588)		404D	1940	Town of Everson	300	NE SE	Municipal Supply
36	D 10		4D	5-30	C. S. Kale Canning Co.	350	NE SE	Industrial
36	A2191	1990	1334A	10-26-51	C. S. Kale Canning Co.	300	NE SE	Industrial
36	A 331	287		8-9-46	Town of Everson	1550	NE SE	Municipal Supply
36	A4149	4104	2962A	10-27-55	G. & L. Kale	150	SW SE	Irr. 17 Ac.
36	A1980	1862	Canc.	5-28-51	J. C. Harder	(100)	SE SE	Irr. 11 Ac.
36	A2513	2382	Canc.	5-12-52	E. Kaemingk	(100)	SE SE	Irr. 10 Ac.
					T.40N.,R.4E			
1	A5213	4899	3415A	4-15-59	H. Den Adel	100	NW NE	Irr. 10 Ac.
1	A5170	Rejected		3-17-59	R. Vos	(130)	Govt Lot 3	Irr. 32 Ac.
1	A2679	2472	1721A	8-14-52	E. E. Snider	180	NW SW	Irr. 30 Ac.
3	A3995	3809	Canc.	5-9-55	R. Easterbrook	(150)	NE SE	Irr. 40 Ac.
6	A1815	1738	1176A	1-24-51	E. E. Loreen	130	Govt Lot 1	Irr. 46 Ac. & Dom.
6	A3598	3386	Canc.	4-29-54	H. W. Graves	(180)	SW NE	Irr. 25 Ac.
6	A1286	1182	578A	12-1-49	C. F. Lovelace	150	SW NE	Irr. 9 Ac.
7	A4935	4659	3400A	7-25-58	R. Glass	200	Govt Lots 3 & 4	Irr. 20 Ac.

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.40N.,R.4E. (Continued)			
8	A3501	3304	2324A	8-28-53	A. Swanson	120	SW SE	Irr. 20 Ac.
8	A2564	2361	1221A	5-29-52	J. J. Stadt, Jr.	180	SE SE	Irr. 39 Ac.
9	A2253	2144	2120A	12-10-51	H. Bosman	180	NE NW	Irr. 40 Ac.
9	A2886	2872	1914A	1-2-53	G. Olson	200	SW SW	Irr. 20 Ac.
9	A2350	2188	1177A	2-20-52	A. L. Olson	180	SE SW	Irr. 50 Ac.
10	A1018	923	885A	10-21-48	G. Buys	225	SE NW	Irr. 20 Ac. & Dom.
10	A3144	3047	2092A	4-6-53	J. Scheffer	175	SE NE	Irr. 38 Ac.
10	A2349	2201	1166A	2-20-52	Gargett Brothers	150	NE SE	Irr. 40 Ac.
10	A5098	4789		1-12-59	J. M. Sterk	300	SW SW	Irr. 30 Ac.
10	A2270	2089	1399A	12-24-51	E. Callenius	200	SE SE	Irr. 34 Ac.
12	A2363	2203	Canc.	2-28-52	A. Brown	(200)	SE NW	Irr. 50 Ac.
12	A2168	2063	Canc.	10-4-51	O. L. & H. Sheets	(400)	SW SW	Irr. 85 Ac. & Dom.
15	A1723	1578	Canc.	11-9-50	D. Leenders	(160)	W½ SW	Irr. 38 Ac.
16	A3620	3346	1989A	5-14-54	J. Bierlink	200	NE NE	Irr. 45 Ac.
16	A3459	3256	1859A	12-16-53	T. B. Carman	150	NW SW	Irr. 35 Ac.
17	A2424	2226	1421A	4-1-52	M. A. Reeck	100	NE NE	Irr. 7 Ac.
17	A2685	2545	1416A	8-25-52	C. E. Berendsen	180	NW NE	Irr. 38 Ac.
17	A5190	4852		3-31-59	M. B. Gillis	800	NW	Irr. 80 Ac.
17	A4861	4734	Canc.	5-14-58	F. Sterk	(200)	SW NW	Irr. 20 Ac.
17	A3139	2968	1985A	4-1-53	B. Scholten	165	SW NE	Irr. 40 Ac.
17	A2506	2446	Canc.	5-8-52	W. Westhoff	(180)	SE NE	Irr. 40 Ac.
17	A2218	2046	1282A	11-14-51	W. Vanderhage	300	N½ SW	Irr. 80 Ac.
17	A4923	4619	3312A	7-21-58	J. Scholten	160	SW SW	Irr. 67.5 Ac.
20	A 448	402	79A	2-7-47	W. Kroontje	200	NW NE	Irr. 36 Ac.
20	A2039	1870	880A	7-23-51	H. Zylstra	160	SE NE	Irr. 17 Ac.
20	A2802	2582	2038A	11-5-52	R. Koster	75	NE SE	Irr. 10 Ac.
27	A4977	4769		8-27-58	C. G. Elsner	120	SE	Irr. 12 Ac.
28	D1135		1073D	1936	J. A. Quinn	150	NW NW	Irr. 26 Ac. & Dom.
28	A2148	1987	Canc.	9-24-51	G. Leenders	(70)	SE NW	Irr. 9 Ac.
28	A5200	4898		4-7-59	T. Pearce	300	NW SE	Irr. 30 Ac.
30	A1706	1557	Canc.	10-16-50	J. L. Hill	(100)	NW NE	Irr. 8 Ac.
31	A4298	4110	2964A	4-30-56	S. H. Barnard & S. Spedding	120	N½ NE	Irr. 9 Ac.
31	A5199	4934		4-7-59	J. Hoekema	200	NE SE	Irr. 60 Ac.
31	A1679	1553	1035A	9-30-50	H. W. Cyr	180	Govt Lots 8 & 9	Irr. 40 Ac.
32	A 326	268	233A	8-1-46	I. B. Green	200	NE NW	Irr. 25 Ac.
32	A 170	142	217A	3-8-46	E. C. Lehman	400	NW SE	Irr. 10 Ac. & Dom.
33	A2061	1877	832A	8-2-51	Great Western Lumber Co.	70	NE NE	Millpond
33	A2361	2149	1159A	2-27-52	P. Berg	100	SW NW	Irr. 8 Ac.
33	A4858	4582		5-12-58	L. Jenkins	150	SE NW	Irr. 25 Ac.
					T.40N.,R.5E.			
6	A2025	2024	1083A	7-3-51	E. B. Jacobson	170	SW NE	Irr. 40 Ac.
34	A1032	914	458A	11-22-48	G. St. James	160	SE SE	Irr. 35.6 Ac.
35	A3169	3006	2443A	4-15-53	Bruns Brothers	120	NW SW	Irr. 38 Ac.
					T.41N.,R.3W.			
35	A5178	4932		3-24-59	Whalens, Inc.	1000	Govt Lot 7	Com. Dom.
					T.41N.,R.1E.			
31	A2042	1861	Canc.	7-9-51	City of Blaine	350	NW SE	Municipal Supply

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.41N.,R.2E.			
35	A3093	2860	1689A	3-19-53	J. Orange	150	E½ SE	Irr. 30 Ac.
35	A5418	5103		10-22-59	H. De Vries	250	W½ SE	Irr. 35 Ac.
36	A4352	4060		6-13-56	M. De Boer	200	W½ SW	Irr. 80 Ac.
					T.41N.,R.3E.			
31	A4611	4345	3200A	5-17-57	R. Noteboom	180	W½ SW	Irr. 63 Ac.
31	A3038	2790	1563A	3-4-53	C. A. Sorgenfrei	150	SE SE	Irr. 20 Ac.
32	A5216	4923		4-17-59	J. Honcoop	175	N½ SW	Irr. 49 Ac.
32	A5215	4922	3447A	4-16-59	W. J. Roosma	150	SW SW	Irr. 37 Ac.
32	A2407	2217	1145A	3-24-52	W. Visser	180	SE SW	Irr. 38 Ac.
33	A5238	4900	3446A	5-5-59	E. Leenders	180	NW SW	Irr. 40 Ac.
33	A2563	2525	Canc.	5-29-52	R. Kortlever	(320)	E½ SE	Irr. 120 Ac.
34	A3610	3416	2383A	5-11-54	K. W. Boeringa	200	NW SW	Irr. 60 Ac.
34	A3937	3774	2652A	3-22-55	A. Honcoop	180	S½ SW	Irr. 20 Ac.
35	A4997	4710	3599A	9-11-58	M. J. Hicks	200	SW SW	Irr. 40 Ac.
36	A2290	2099	2208A	1-11-52	W. H. Ehlers	200	S½	Irr. 50 Ac.
36	A4292	4036	2637A	4-25-56	E. Ondeck	130	SW SW	Irr. 18 Ac.
36	A2357	2167	1556A	2-26-52	W. H. Ehlers	200	SE SE	Irr. 38 Ac.
					T.41N.,R.4E.			
31	A4439	4157	2827A	9-17-56	K. S. Johnson	55	NE SE	Irr. 15 Ac.
31	A2421	2218	1283A	3-31-52	H. Johnson	300	Govt Lots 5 & 6	Irr. 50 Ac.
31	A3131	2918	1641A	3-30-53	V. L. Estergreen	150	SW SE	Irr. 40 Ac.
31	A2294	2093	1150A	1-14-52	G. W. Nestle	110	SE SE	Irr. 20 Ac.
33	A5328	4987	3485A	6-22-59	Town of Sumas	2250	Govt Lot 1	Municipal Supply
					T.41N.,R.5E.			
31	A1950	1818	863A	5-12-51	G. Groen	180	S½ SW	Irr. 53 Ac.
31	A2617	2417	2799A	6-26-52	G. Postma	200	SW SE	Irr. 40 Ac.
32	A4334	4080	2691A	6-1-56	R. Vander Meulen	200	SW SW	Irr. 90 Ac.

Sec.	Appl.	Permit	Cert.	Priority	Name	Quantity(gpm)	Well Loc.	Use
					T.39N.,R.1E. (Continued)			
6	A2537	2398	1444A	5-19-52	Bell Bay Jackson Water Assn.	60	NE NE	Dom.
6	A1762	1572	1061A	12-26-50	M. Haugen	45	SW NW	Irr. 5 Ac. & Dom.
9	A2063	1989	Canc.	8-3-51	Pleasant Valley Water Assn.	(30)	SW NW	Dom.
13	A1136	1082	393A	6-2-49	Aldergrove Water Assn.	25	NW NW	Dom. & Farm
13	A2008	1853	897A	6-18-51	Thornton Water Assn.	55	S½ SE	Com. Dom.
14	A1609	1442	983A	7-28-50	North Star Water Assn.	55	SE SW	Com. Dom., Stock & Dairy Farm
15	A2201	2053	1994A	11-9-51	L. Terrell Water Assn.	25	NW NE	Com. Dom.
18	A2888	2675	Canc.	1-2-53	G. Bruland	(200)	Govt Lot 2	Irr. 20 Ac. & Dom.
21	A2083	1903	Canc.	8-17-51	J. R. Malle	(80)	NE SW	Irr. 10 Ac.
21	A2053	1977	Canc.	7-30-51	W. E. Alley	(160)	NW SW	Irr. 20 Ac.
21	D 517		517D	12-44	J. R. Waylett	5	SW SW	Dom. & Stock
24	A 327	260	1739A	8-1-46	J. E. Sundstrom	15	SE NE	Com. Dom.
26	A1540	Rejected		6-8-50	M. M. Moles	(25)	SE SW	Irr. 20 Ac. & Dom.
28	A 485	455	194A	3-21-47	C. W. Anderson	25	SW NW	Irr. 10 Ac., Stock & Dom.
28	A3507	3290	2366A	2-9-54	W. T. Follis	20	NW SW	Dom.
35	A3981	3741	2864A	5-2-55	A. M. Illman	100	E½ SE	Irr. 50 Ac.
					T.39N.,R.2E.			
1	A4006	3748		5-19-55	J. A. Anderson	90	Govt Lot 4	Irr. 9 Ac.
1	A1898	1784	1025A	4-5-51	G. M. Hickey	120	SW SW	Irr. 20 Ac.
1	A2081	2037	1157A	8-16-51	K. Williams	150	SE SW	Irr. 15 Ac. & Dom.
1	A2490	2287	1877A	5-1-52	W. Boxx	200	SW SE	Irr. 20 Ac.
1	A2257	2073	2235A	12-12-51	R. Edwin	160	SW SE	Irr. 30 Ac.
2	A 288	240	27A	6-24-46	J. Aker	250	NW NE	Irr. 20 Ac.
2	A2824	2597	2373A	11-25-52	B. Altena	200	Govt Lot 3	Irr. 28 Ac.
2	A 289	332	Canc.	6-24-46	H. Brunhaver	(200)	SW NW	Irr. 75 Ac.
2	A 290	246	404A	6-24-46	R. A. & J. E. Kellner	(200)	SE NW	Irr. 10 Ac.
4	A2746	2616	2302A	10-9-52	R. Anderson	136	Govt Lot 4	Irr. 17 Ac.
4	A3215	2933	2666A	5-13-53	R. M. Rhea	140	SE NW	Irr. 14 Ac.
4	A3140	2015	Canc.	4-2-53	E. H. Hatter	(200)	NE SW	Irr. 35 Ac.
4	A1851	1761	747A	3-5-51	R. Dusenbery	200	NW SW	Irr. 20 Ac.
4	A2714	2495	1735A	9-17-52	C. Holmes	150	SW SW	Irr. 20 Ac.
5	A4743	4479	3354A	1-2-58	F. Eagle	130	NE SE	Irr. 13 Ac.
5	D1026		1013D	6-1-35	H. E. Taylor	60	SW NE	Irr. 25 Ac. & Dom.
5	A3423	3275	Canc.	11-6-53	J. W. Mershon	(200)	SW SE	Irr. 20 Ac.
5	A3674	3479	2803A	6-14-54	R. O'Brine	150	SE SE	Irr. 15 Ac.
6	A2715	2474	2248A	9-17-52	H. F. Rasmussen	160	SE NW	Irr. 51 Ac.
6	A3041	2866	2505A	3-5-53	W. T. Handy	200	W½ SW	Irr. 70 Ac.
6	A3193	2960	2184A	5-1-53	B. Ruffino	320	E½ SE	Irr. 32 Ac.
7	A2326	2147	1995A	2-8-52	L. Hansen	130	NW NE	Irr. 20 Ac.
7	A 56	55	714A	12-10-45	Orchard Water Assn.	50	SW SW	Irr. 2.5 Ac. & Com. Dom.
9	A5179	4866		2-24-59	E. Gorsinger	200	SW NW	Irr. 40 Ac.
10	A4859	4639	3521A	5-13-58	M. W. Witter	160	N½ NE	Irr. 55 Ac.
10	A2434	2220	1458A	4-4-52	C. Nyhus	180	SW NE	Irr. 30 Ac.
10	A 924	841	2675A	6-17-48	G. S. Bacon	160	SE NE	Irr. 50 Ac. & Dom.
10	A 482	451	502A	3-17-47	W. J. Clarkson	100	SE SW	Irr. 5 Ac.
10	A5104	4848		1-19-59	L. Doyle	160	SW SE	Irr. 80 Ac.
11	A3657	3374	2023A	6-2-54	P. O. Maneval	120	NE NE	Irr. 20 Ac.

APPENDIX B

Appendix B lists all valid surface-water filings in the study area as of January 1, 1960. Cancelled permits and rejected applications are not listed since it is assumed no diversions are taking place under them.

These rights are listed on a drainage area basis, with three major drainages, which are the Nooksack River, Coastal Area, and Sumas River drainage. Sub-basins are listed separately within each major basin. In the Nooksack and Sumas basins, the sub-basins are listed in ascending order of their junction with the main stream, while in the coastal area they are arranged geographically, north to south.

The first three columns of the tabulation refer to the application, permit, and certificate numbers of a particular right. The absence of a number in a column indicates that an application has not yet progressed to permit status or has not been perfected to certificate.

The priority column indicates the date upon which the application was received; thus determining its priority relative to other rights which may affect or be affected by it.

The source column lists the specific body of water from which the diversion is made.

The next column, "Name," refers to the name of the applicant, permittee, or original holder of the certificate, and does not necessarily refer to the present holder of the right or owner of the land. Once a certificate of water right is issued, it becomes appurtenant to the land, and the Division of Water Resources does not retain records of changes of ownership.

The quantity column lists the amount of water in cubic feet per second which may be diverted under a specific right. Storage capacity is shown in acre-feet.

The location of point of diversion column indicates the township, range, smallest recorded sub-division, and section in which the diversion point is situated.

The use column shows the specific utilization under the right, and in the case of irrigation, lists the number of acres. The following abbreviations are used in this column.

Ac. ----------------------	Acres
Com. Dom. ----------------	Community Domestic
Fire Prot. -----------------	Fire Protection
Fish ---------------------	Fish Propagation
Ind. ----------------------	Industrial
Irr. -----------------------	Irrigation
Wild ----------------------	Wildlife

APPENDIX B

SURFACE-WATER RIGHTS ON RECORD WITH THE DIVISION OF WATER RESOURCES AS OF JANUARY 1, 1960

NOOKSACK RIVER BASIN DRAINAGE

Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.	Subdivision	Sec.)	Use
7269	4958	4384	6-24-46	Nooksack River	H. Kellner	0.11	40/2E	Govt Lot 4	34	Irr. 11 Ac.
7270	4787	3875	6-24-46	Nooksack River	R. A. Kellner	0.11	40/2E	Govt Lot 6	35	Irr. 11 Ac.
7693	5099	3624	3-17-47	Nooksack River	W. J. Clarkson	0.20	39/2E	Govt Lot 8	9	Irr. 20 Ac.
10297	7564	5052	5-4-51	Nooksack River	M. G. Freeman	0.30	39/2E	Govt Lot 3	21	Irr. 30 Ac.
10651	7608	4406	8-23-51	Nooksack River	L. Frasier	0.60	40/3E	S½SE	21	Irr. 60 Ac.
11579	8556	5629	8-12-52	Nooksack River	H. Bergsma	0.60	39/2E	Govt Lot 7	29	Irr. 60 Ac.
11970	8809	6000	1-13-53	Nooksack River	General Petroleum Co.	5.00	39/2E	Govt Lot 2	29	Manufacturing
12259	9043	6613	4-14-53	Nooksack River	B. Luther	0.25	39/2E	W½NW	21	Irr. 25 Ac.
12322	9100	5442	5-5-53	Nooksack River	I. Strickland	0.80	39/2E	Govt Lot 6	3	Irr. 80 Ac.
12424	9199		6-22-53	Nooksack River	I. Anderson	0.36	39/2E	Govt Lot 4	32	Irr. 35 Ac. & Dom.
12453	9393	6003	7-15-53	Nooksack River	E. D. Alderson	0.40	40/2E	Govt Lot 8	36	Irr. 40 Ac.
12796	9590	5859	3-4-54	Nooksack River	P. H. Stuurmans	0.12	40/3E	Govt Lot 7	20	Irr. 12 Ac.
13039	9705	6343	7-23-54	Nooksack River	J. D. Parcher	0.50	40/3E	Govt Lots 8, 10 & 11	30	Irr. 50 Ac.
13788	10337	7307	4-2-56	Nooksack River	R. L. Nutter	0.60	40/2E	Govt Lot 4	34	Irr. 60 Ac.
13816	10396	7008	4-26-56	Nooksack River	G. T. Bode	0.325	40/3E	Govt Lot 5	30	Irr. 32.5 Ac.
13921	10482	6820	6-13-56	Nooksack River	V. B. Ritter	0.20	40/2E	Govt Lot 5	35	Irr. 20 Ac.
13923	10426	7009	6-15-56	Nooksack River	F. E. Landaal	0.70	39/2E	Govt Lots 9 & 10	16	Irr. 70 Ac.
14040	10579	6921	8-22-56	Nooksack River	G. J. Polinder	0.40	40/3E	Govt Lot 4	29	Irr. 40 Ac.
14152	10598	6821	12-3-56	Nooksack River	City of Lynden	5.00	40/3E	Govt Lot 4	20	Municipal Supply
14207	10649	7285	1-28-57	Nooksack River	H. De Valois	0.27	40/3E	Govt Lot 2 & S½SW	29 20	Irr. 32 Ac.
14333	10756		5-16-57	Nooksack River & Pond	W. Scholten	1.24	39/4E	NW¼ & Govt Lot 6	6	Irr. 124 Ac.
14758	11188		4-21-58	Nooksack River & Unnamed Ditch	J. A. Timmer	**0.16	40/3E	NENW & Govt Lot 8	30	Irr. 16 Ac.
14860	12017	7634	6-19-58	Nooksack River	A. & E. Elsasser	0.78	39/2E	Govt Lots 6, 7 & 11	32	Irr. 78 Ac.
15167	11236		11-14-58	Nooksack River	O. Hovander	0.30	39/2E	Govt Lot 1	32	Irr. 30 Ac.

Distributary of Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion	Use
13056	9730	7078	8-3-54	Steamboat Slough	D. L. Abshire	0.10	J. G. Hedge D.L.C., #41 (38/2E SWSE 7)	Irr. 10 Ac.

Tenmile Creek Drainage

Tenmile Creek Tributary Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
1790	795	211	7-15-26	Tenmile Creek	B. S. Hillier	0.20	39/2E	SWSE	13	Irr. 10 Ac. & Dom.
2036	971	269	3-26-27	Tenmile Creek	C. K. McMillin	2.00	39/2E	E½SW	22	Irr. 40 Ac.
Certificate of Change		642			A. C. Pottle					
2222	1120	330	1-11-28	Tenmile Creek	J. E. McDonald	0.25	39/2E	SWNW	23	Irr. 10 Ac.
2362	1178	306	7-11-28	Tenmile Creek	W. F. Locke	0.05	39/2E	SESW	13	Dom. & Garden
4152	2276	1974	9-11-35	Barrett Lake	H. K. Russell	0.30	39/2E	SWSW	21	Irr. 30 Ac.
6669	4313	3165	9-14-45	Tenmile Creek	J. Boyd	0.13	39/3E	Govt Lot 3	18	Irr. 13 Ac.
7026	4567	2565	4-4-46	Tenmile Creek	J. Lee Bruns	0.15	39/2E	SESW	13	Irr. 15 Ac.
7253	4775	3102	6-15-46	Tenmile Creek	F. Oltman	0.20	39/3E	NWSE	18	Irr. 20 Ac.
7431	4830	2837	9-5-46	Tenmile Creek	J. E. Bruns	0.10	39/2E	SESW	13	Irr. 10 Ac.
7640	5021	6291	2-15-47	Tenmile Creek	A. M. Hougan	0.30	39/2E	NWSE	22	Irr. 40 Ac.
8438	6091	3959	5-18-48	Tenmile Creek	L. Egerdal	0.13	39/2E	SWSW	13	Irr. 13 Ac.
Certificate of Change		625			L. Egerdal					
8697	6308	5819	12-27-48	Tenmile Creek	L. Kent	0.30	39/2E	SENE	22	Irr. 30 Ac.
9498	6677	4046	3-31-50	Tenmile Creek	H. Cole	0.28	39/3E	SESW	18	Irr. 28 Ac.
9757	7051	5658	7-12-50	Barrett Lake	R. Downey	0.09	39/2E	SESW	21	Irr. 9 Ac.
10477	7511	5747	7-10-51	Tenmile Creek	H. Glass	0.19	39/3E	NESE	18	Irr. 19 Ac.
10598	7627		8-10-51	Tenmile Creek	J. Murray	0.20	39/3E	SWNE	26	Irr. 20 Ac.
10876	8086	7226	11-15-51	Barrett Lake	A. Schachtschneider	0.125	39/2E	SWSW	21	Irr. 12 Ac.

** Diversion allowed from Nooksack River and Unnamed Ditch, total quantity not to exceed 0.16 cfs.

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	(Subdivision)	(Sec.)	Use

NOOKSACK RIVER BASIN DRAINAGE

Tenmile Creek Drainage (Continued)

Tenmile Creek Tributary Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
10888	11742		11-21-51	Tenmile Creek	S. A. Tarr	0.30	39/3E	NWNE	21	Irr. 30 Ac.
11210	8164	6247	3-31-52	Barrett Lake	E. Bellingar	0.02	39/2E	SWSW	21	Irr. 2 Ac.
16016			9-4-52	Tenmile Creek	D. L. Anderson	0.35	39/2E	NENW	23	Irr. 50 Ac.
11877	8806	6248	12-3-52	Barrett Creek	D. McKay	0.26	39/2E	NESE	20	Irr. 26 Ac.
12369	9180	6666	5-27-53	Barrett Lake	A. Bryant	0.07	39/2E	SWSW	21	Irr. 7 Ac.
12480	9200	6824	8-3-53	Barrett Lake	R. Stanton	0.30	39/2E	SWSE	21	Irr. 30 Ac.
13875	10415		5-28-56	Barrett Lake & Springs	J. Byers	1.00	39/2E	SESE	21	Irr. 30 Ac., Dom. & Fish
16059			9-10-56	Tenmile Creek	R. B. Hong	0.20	39/2E	SWSW	22	Irr. 20 Ac.

Deer Creek Tributary Barrett Lake

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
5653	3623	2404	2-26-42	Deer Creek	J. Roth	0.03	39/2E	NENW	27	Irr. 3 Ac.
7288	5455	4712	6-27-46	Deer Creek	C. A. Erdman	0.005	39/2E	NESW	26	Dom.

Ravine Creek Tributary of Tenmile Creek

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
4714	2687	1221	1-10-39	Ravine Creek	Woodlawn Cemetery	0.25	39/2E	SENW	22	Irr. 10 Ac.

Fourmile Creek Tributary Tenmile Creek

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
4898	2987	1762	7-6-39	Fourmile Creek	Fircrest Farm	0.55	39/3E	NWSE	9	Irr. 50 Ac.
6235	4013	2401	11-13-44	Fourmile Creek	E. D. Kenoyer	0.40	39/3E	SENW	18	Irr. 40 Ac.
6586	4372	2792	8-23-45	Fourmile Creek	F. Snydar	0.19	39/3E	NWNE	18	Irr. 19 Ac.
6672	4314	3166	9-18-45	Fourmile Creek	J. Boyd	0.15	39/3E	Govt Lot 3	18	Irr. 15 Ac.
7835	5627	4420	5-23-47	Green Lake	J. E. Roosma	0.15	39/3E	NENE	9	Irr. 15 Ac.
8317	5856	3851	4-5-48	Fourmile Creek	E. Brown	0.14	39/3E	SWNE	18	Irr. 14 Ac.
10556	7622	4935	8-1-51	Fourmile Creek	F. Snydar	0.60	39/3E	SWNE	18	Irr. 60 Ac.
15428	11486		5-19-52	Fourmile Creek	D. Parker	0.39	39/3E	N½NE	18	Irr. 39 Ac.
11783	8804	6443	10-22-52	Green Lake	J. Elene	0.40	39/3E	NWNW	10	Irr. 40 Ac.
13354	10081	6702	3-28-55	Green Lake	N. Lunde	0.20	39/3E	SENE	9	Irr. 20 Ac.
13863	10347	6947	5-23-56	Unnamed Pond	J. Garrison	0.05	39/3E	W½NW	15	Irr. 5 Ac.
15429	11611		7-18-56	Fourmile Creek	B. Vander Ploeg	0.80	39/3E	SESW	8	Irr. 80 Ac.
15265	11297		12-16-58	Fourmile Creek	G. Alvord	0.40	39/3E	SWNW	18	Irr. 40 Ac.

Silver Spring Brook Tributary Tenmile Creek

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
4744	2725	2277	2-18-39	Silver Spring Br.	W. Holz	0.20	39/3E	NENW	19	Irr. 20 Ac. & Dom.
4858	2927	1952	5-31-39	Silver Spring Br.	W. Holz	0.25	39/3E	SENW	19	Irr. 20 Ac. & Dom.
4861	2918	2308	6-1-39	Silver Spring Br.	J. Ward	0.35	39/3E	SESW	18	Irr. 30 Ac. & Dom.

Unnamed Tributary of Tenmile Creek

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
12625	9521	6229	10-22-53	Unnamed Pond	E. K. Ahrens, Jr.	0.30	39/3E	S½NE	23	Irr. 30 Ac.

Unnamed Ditch Tributary Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
7718	5100	3625	3-29-47	Unnamed Ditch	W. J. Clarkson	0.67	39/2E	S½SE	9	Irr. 70 Ac.

Wiser Lake Creek Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
3504	1890	2460	9-8-31	Wiser Lake Creek	S. H. Johnson	0.85	39/2E	SWSE	3	Irr. 85 Ac. & Dom.
7434	4836	3950	9-6-46	Wiser Lake Creek	J. Aker	0.38	39/2E	E½SW	2	Irr. 40 Ac.
7675	5095	3097	3-11-47	Wiser Lake Creek	A. Dodd	0.20	39/2E	W½SW	2	Irr. 60 Ac.
9058	6140	3701	9-8-49	Wiser Lake	J. V. Hopfinger	0.10	39/3E	SENW	6	Irr. 10 Ac.
10069	7368	6471	1-17-51	Bellingar Ditch	O. Dykstra	0.20	39/3E	Govt Lot 4	5	Irr. 30 Ac.
10506	7775	5947	7-17-51	Wiser Lake Creek	B. A. Strickland	0.26	39/2E	NESE	3	Irr. 26 Ac.
10841	7876	5603	10-29-51	Wiser Lake Creek	S. H. VanWoudenberg	0.75	39/2E	Govt Lot 1 N½NW	9 10	Irr. 147 Ac.
10802	7750	5093	10-15-51	Wiser Lake	F. Steensma	0.30	39/3E	SWNE	6	Irr. 30 Ac.
11128	8067	5148	3-10-52	Wiser Lake	C. D. Bartlett	0.09	39/3E	SENW	6	Irr. 9 Ac.
11216	8136	6220	4-4-52	Wiser Lake	J. Jansen	0.21	39/3E	Govt Lot 5	6	Irr. 20 Ac. & Dom.
11310	8256	5470	5-1-52	Wiser Lake	W. A. Rhea	0.18	39/2E	E½NE	1	Irr. 18 Ac.
11997	9445	5875	1-22-53	Wiser Lake	I. Johnston & I. DeWaard	0.53	39/2E	Govt Lot 2	1	Irr. 53 Ac.

NOOKSACK RIVER BASIN DRAINAGE

Schneider Ditch Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	Subdivision	Sec.	Use
4214	2301	1552	4-6-36	Schneider Ditch	W. Menser	0.10	40/2E	NESW	29	Irr. 20 Ac.
6890	7179	5228	2-7-46	Unnamed Stream	W. E. Knutsen	0.40	39/2E	NWNE	4	Irr. 40 Ac.
11005	8107	4843	1-29-52	Schneider Ditch	G. Monson	0.76	39/2E	E½NE	4	Irr. 76 Ac.
11199	8121	4808	3-31-52	Schneider Ditch	C. Wilson	0.35	40/2E	N½NW	33	Irr. 100 Ac.
11406	8415	6142	5-29-52	Schneider Ditch	L. Bode	0.25	40/2E	SESW & NWNE	29 32	Irr. 25 Ac.
11946	8829	6507	1-7-53	Schneider Ditch	G. Barnes	0.80	39/2E	SWSE & Govt Lot 2	4 9	Irr. 85 Ac.
12411	9297	6499	6-15-53	North Branch Schneider Ditch	P. R. Jeffcott	0.10	40/2E	N½SW	28	Irr. 10 Ac.
13400	10118	7358	4-27-55	Unnamed Ditch	L. Webster	0.15	40/2E	NENW	32	Irr. 15 Ac.

Bertrand Creek Drainage

Bertrand Creek Tributary Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	Subdivision	Sec.	Use
1546	671	290	11-12-25	Bertrand Creek	O. L. Sheets	0.80	40/2E	SESW	14	Irr. 20 Ac. & Dom.
Certificate of Change		360			O. L. Sheets					
5117	3052	1384	3-28-40	Bertrand Creek	L. Brown	0.67	40/3E	SESE	22	Irr. 62 Ac.
6952	4495	4472	2-7-46	Bertrand Creek	P. M. Johansen	1.10	40/2E	NWNE	27	Irr. 110 Ac.
7174	4675	2630	5-25-46	Bertrand Creek	I. R. Stauffer	0.25	40/2E	SENE	2	Irr. 25 Ac.
7312	4839	2691	7-10-46	Bertrand Creek	M. Bayes	0.20	40/2E	SESE	11	Irr. 20 Ac. & Dom.
7323	4728	2646	7-15-46	Bertrand Creek	A. F. Kelly	0.25	40/2E	NENW	23	Irr. 25 Ac.
7348	4834	4554	7-30-46	Bertrand Creek	G. Bennink	0.50	40/2E	NESW	27	Irr. 50 Ac.
7520	5432	3469	11-2-46	Bertrand Creek	E. Crandall	0.25	40/2E	SENE	11	Irr. 25 Ac. & Dom.
8081	5433	3470	10-20-47	Bertrand Creek	E. Crandall	0.34	40/2E	NESE	11	Irr. 40 Ac.
9008	6104	3726	7-16-49	Bertrand Creek	E. Tremain	0.20	40/2E	SWSW	26	Irr. 20 Ac.

McClelland Creek Tributary Bertrand Creek

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	Subdivision	Sec.	Use
5571	3417	2109	9-2-41	McClelland Creek	O. L. Sheets	0.70	40/2E	NWNE	22	Irr. 70 Ac.
8111	7632	4627	11-15-47	McClelland Creek	C. McClelland	0.50	40/2E	S½ SE	15	Irr. 100 Ac.
12412	9184	5726	6-15-53	McClelland Creek	W. E. Holt	0.18	40/2E	SENE	22	Irr. 18 Ac.

Unnamed Tributary of Bertrand Creek

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	Subdivision	Sec.	Use
7407	4767	4376	8-26-46	Unnamed Slough	R. Dawson	0.10	40/2E	SENW	27	Irr. 10 Ac.
9876	7032	4435	9-10-50	Unnamed Stream	J. B. Wakefield	0.10	40/2E	SWNW	22	Irr. 10 Ac.
15156	11471		10-29-58	Unnamed Stream	A. Stauffer	0.40	40/2E	NWNW	10	Irr. 40 Ac.

Fishtrap Creek Drainage

Fishtrap Creek Tributary Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	Subdivision	Sec.	Use
1548	672	702	11-16-25	Fishtrap Creek	Whatcom County Dairymen's Association	1.55	40/3E	NWNE	20	Fire Prot. & Manufacturing
5557	3421	1826	8-18-41	Fishtrap Creek	W. H. Waples	0.67	40/3E	SENW & NWSW	16	Irr. 75 Ac.
7492	5242	2974	10-7-46	Fishtrap Creek	A. C. Crabtree	0.34	40/3E	E½SE	17	Irr. 34 Ac.
7737	5545	3748	4-5-47	Fishtrap Creek	W. Telgenhoff	0.05	40/3E	SESW	19	Irr. 5 Ac.
7948	5581	3575	7-26-47	Fishtrap Creek	H. Stremler	0.20	40/3E	S½N½	9	Irr. 20 Ac.
8700	6135	3576	2-18-49	Fishtrap Creek	H. Stremler	0.30	40/3E	S½N½	9	Irr. 40 Ac.
11201	8135	4881	3-31-52	Fishtrap Creek	A. Kelly	0.10	40/3E	SENE	19	Irr. 10 Ac.

Tributaries of Fishtrap Creek

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	Subdivision	Sec.	Use
1142	441	95	7-19-24	Double Ditch	P. M. Serrurier	1.00	40/3E	S½S½	18	Irr. 80 Ac.
4659	2713	1830	10-27-38	Double Ditch	Anderson & Cruikshank	0.20	40/3E	SENE	19	Irr. 17 Ac.
5048	3067	4097	1-4-40	W. Guide Meridian Ditch	H. Tromp	1.00	40/2E	NESW	13	Irr. 100 Ac.
5661	3594	2362	3-10-42	Double Ditch	A. Hempel	0.10	40/3E	SWSE	6	Irr. 10 Ac.
5857	3780	3434	6-25-43	E. Guide Meridian Ditch	J. Harcoff, Sr.	0.20	40/3E	NWNW	19	Irr. 20 Ac.
7244	5355	3627	6-13-46	Double Ditch	Double Ditch Water Assn.	5.0	40/3E	Govt Lots 2 & 3	31	Dom., Stock & Irr. (Gardens)
14758	11188		4-21-58	Nooksack River & Unnamed Ditch	J. A. Timmer	**0.16	40/3E	NENW & Govt Lot 8	30	Irr. 16 Ac.

** Diversion allowed from both Nooksack River and Unnamed Ditch, total quantity not to exceed 0.16 cfs.

NOOKSACK RIVER BASIN DRAINAGE

Scott Ditch (Drainage Ditch #22) Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.	Subdivision	Sec.)	Use
2028	978	1358	3-9-47	Elder Ditch	G. Knittel	1.00	40/3E	E½NE	33	Irr. 40 Ac.
2723	1395	1764	9-30-29	Scott Ditch	R. Van Dyk	0.80	40/3E	NENE & NWNW	34 35	Irr. 97 Ac.
5428	3328	4277	4-24-41	Scott Ditch	C. E. Osgood	0.66	40/3E	S½SE	29	Irr. 66 Ac.
6781	4485	2524	11-23-45	Scott Ditch	O. Graep	0.40	40/3E	SE NW	35	Irr. 40 Ac.
7073	4576	2645	4-24-46	Elder Ditch	A. Burns	0.35	39/3E	Govt Lot 1	3	Irr. 17.5 Ac.
8406	6275	7046	5-20-48	Scott Ditch	E. E. Nolte	0.75	40/3E	NWSW	36	Irr. 137 Ac.
10333	7459	4285	5-14-51	Scott Ditch	A. Brue	0.20	40/3E	SENE	35	Irr. 20 Ac.
10891	7905	5036	11-23-51	Scott Ditch	J. Andriesen	0.24	40/3E	SWSW	28	Irr. 32 Ac.
11069	8078	4867	2-18-52	Scott Ditch	C. E. Osgood	0.20	40/3E	NWNW	33	Irr. 20 Ac.
13999	10593	7135	3-6-56	Elder Ditch & Scott Ditch	P. Van Dyk, Sr.	0.70	40/3E	E½NE & N½NW	33 34	Irr. 70 Ac.
13916	10481	7116	6-11-56	Scott Ditch	J. Elenbaas	0.20	40/3E	NENW	33	Irr. 20 Ac.
14486	12055	7794	7-1-57	Scott Ditch	J. Roosma	0.18	40/3E	NWNE	33	Irr. 18 Ac.
15453	11548		5-11-59	Scott Ditch	S. Vander Veen	0.40	40/3E	SWNE	35	Irr. 40 Ac.

Stickney Slough Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
5418	3369	4213	4-18-41	Harvey Creek	J. Alexander, et al	0.04	40/3E	W½SW	11	Dom. & Stock
6503	4242	2352	6-28-45	Kamm Ditch	W. VandeKamp	0.34	40/3E	SWSE	15	Irr. 40 Ac.
10945	8074		12-31-51	Unnamed Stream	G. Bajema	0.30	40/3E	SWSW	11	Irr. 30 Ac.
11127	8132	4796	3-10-52	Mormon Ditch	P. VanDyken	0.30	40/3E	SWNW	22	Irr. 30 Ac.
11131	8212	5183	3-10-52	Stickney Slough	N. Beukelman	0.24	40/3E	E½E½	20	Irr. 24 Ac.
11241	8574	5645	4-14-52	Mormon Ditch	B. Meenderinck	0.25	40/3E	SENE	22	Irr. 25 Ac.
12277	9195	6870	4-20-53	Kamm Ditch	J. Wagter	0.20	40/3E	SESE	15	Irr. 20 Ac.
12543	9446	6623	8-31-53	Stickney Slough	G. W. Frick	0.10	40/3E	SWNW	21	Irr. 10 Ac.
13032	9742	6617	7-20-54	Kamm Ditch & Mormon Ditch	J. Weeda	0.20	40/3E	SESW & NENW	15 22	Irr. 20 Ac.
13963	10429	7010	6-15-56	Stickney Slough	F. Landaal	0.07	40/3E	SWNW	21	Irr. 7 Ac.

Anderson Creek Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
2528	1329	872	2-16-29	Anderson Creek	Bellingham National Bank	0.05	38/4E	NWNW	17	Irr. & Dom.
4241	2321	1129	6-16-36	East Fork Anderson Creek	Glen Echo Coal Company	1.1	38/4E	NENW	8	Mining & Power
5767	3636	2408	12-9-43	Anderson Creek	E. W. Gooding	0.01	38/4E	NENE	7	Dom. & Industrial
8430	5839	3480	5-28-48	Anderson Creek	L. L. Ladiser	0.01	38/4E	NWSE	6	Dom.
12320	9262	6644	5-4-53	Unnamed Brook	D. Cress	0.11	38/4E	NENW	17	Irr. 10 Ac. & Dom.
14921	12034		7-18-58	Unnamed Creek	R. Burgy	0.60	39/4E	NWNW	32	Irr. 60 Ac.
15003	11191	7506	8-19-58	Unnamed Creek	F. Lange	0.011	39/4E	NWNW	29	Irr. 1.1 Ac.
15096	11194		9-23-58	Unnamed Pond	W. Meyer	0.35	39/4E	NWSW	29	Irr. 35 Ac.

Smith Creek Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
5384	3297	1736	3-14-41	Smith Creek	I. O. Hilliard	0.10	39/4E	NWNE	26	Irr. 8 Ac. & Dom.
7119	4613	2614	5-14-46	Smith Creek	F. I. Hatley	0.07	39/4E	SESW	22	Irr. 7 Ac.
7381	4763	3374	8-12-46	Unnamed Slough	E. Cutler	0.04	39/4E	NWSE	26	Irr. 4 Ac. & Dom.
7802	5244	3468	5-5-47	Unnamed Spring	B. Knight	0.05	39/5E	Govt Lot 5	31	Irr. 20 Ac.
10207	7347	4196	3-24-51	Smith Creek	H. Hoytema	0.24	39/4E	SWNE	21	Irr. 24 Ac.

South Fork Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
4372	4402		4-6-37	So. Fork Nooksack	City of Bellingham	50.0	37/5E	NE	35	Municipal
5657	3633	1910	3-6-42	So. Fork Nooksack	Marona Mill Company	2.50	37/5E	Govt Lot 9	6	Millpond
6477	4257	2900	6-7-45	Olsens Slough	L. Sygitowicz	0.20	38/5E	Govt Lot 11	7	Irr. 36 Ac.
11004	7957	5166	1-28-52	So. Fork Nooksack	P. Gravesgard	0.09	37/5E	Govt Lot 1	6	Irr. 9 Ac.

Various Tributaries South Fork Nooksack River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
4156	2273	936	9-18-35	McCarty Creek	Marona Mill Company	0.20	37/4E	SENE	1	Millpond
5524	3412	1719	7-24-41	Jones Creek	E. E. Boyd	0.05	37/5E	NENW	7	Millpond
7265	4765	4266	6-20-46	Unnamed Spring	W. Teeple	0.30	38/5E	SWSW	18	Irr. 30 Ac.
7820	5210	3555	5-15-47	Unnamed Creek	F. A. Kuipers	0.02	38/5E	SWSE	7	Dom.
10327	7471	4335	5-11-51	Unnamed Stream	W. W. Carr	0.05	37/5E	SWSE	21	Com. Dom.
12898	9593	6608	5-4-54	Black Slough	A. J. Johnson	0.50	38/5E	E½SW	20	Irr. 50 Ac.
14369	10751	7310	6-14-57	Unnamed Pond Tributary Black Slough	C. Longstreth	0.40	38/5E	NENE	19	Irr. 40 Ac.

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.	Subdivision	Sec.)	Use
				NOOKSACK RIVER BASIN DRAINAGE						
				Various Tributaries South Fork Nooksack River						
15023	11362		8-27-58	Unnamed Brook	C. Keplinger	0.20	38/5E	NENE	17	Irr. 20 Ac.
15384	11441		4-8-59	Unnamed Tributary	C. Dickey	0.30	37/5E	NWSW	5	Irr. 30 Ac.
				Middle Fork Nooksack River						
1517	615	98	10-15-25	Canyon Creek	Chicago, Milwaukee, St. Paul & Pacific Railroad	0.10	39/5E	SESE	27	Railway
13150	9855		10-6-56	Middle Fork Nooksack River	City of Bellingham	250.0	38/6E	NE	19	Municipal, Ind. & Dom.
				North Fork Nooksack River						
13696	10406	6754	11-22-55	N. Fork Nooksack	State Fisheries	3.00	39/5E	Govt Lot 9	3	Fish
				Maple Creek Drainage Tributary North Fork Nooksack River						
2711	1387	386	9-20-29	Ferry Creek	H. J. Bouma	1.00	40/6E	SWSW	8	Dom. & Lights
Certificate of Change		447			H. J. Bouma					
2838	1511	759	1-29-30	Unnamed Stream	A. L. Bennett	0.10	40/6E	Govt Lot 11	7	Power & Fire Prot.
4320	2398	1027	12-4-36	Peterson Creek	H. P. Jukes	1.0	40/6E	Govt Lot 13	6	Dom. & Power
6838	4558	2775	1-7-46	Unnamed Spring	A. Sooter	0.01	40/6E	SENW	30	Dom.
7139	4986	2751	5-17-46	Beal Creek	F. D. Fobes	0.01	40/6E	SWSW	20	Dom.
7197	4985	2752	5-31-46	Doakes Creek	A. L. & F. D. Fobes	0.03	40/5E	SESE	24	Irr. 1.5 Ac. & Dom.
7988	5575	3131	8-18-47	Unnamed Spring	Maple Falls Water Coop.	0.2	40/6E	SESE	19	Dom.
8011	5510	3033	8-30-47	Unnamed Spring	Orville Ferry	0.01	40/6E	Govt Lot 10	7	Dom. & Stock
10989	8076	5995	1-18-52	Ferry Creek	M. F. German	0.45	40/6E	NESE & NENW	18 17	Irr. 44 Ac. & Dom.
12812	9878	6772	3-15-54	Ferry Creek	H. J. Bouma	0.60	40/6E	SWSW	8	Irr. 60 Ac.
				Various Tributaries North Fork Nooksack River						
4265	2305	970	8-1-36	Galena Creek	Mt. Baker Ski Club	0.80	39/9E		17	Hydro-Electric
4377	2492	1150	4-15-37	Unnamed Tributary Thompson Creek	U. S. Forest Service	0.1	39/7E	NESW	8	Dom.
4415	2493	1145	6-2-37	Unnamed Stream Trib. N. Fork Nooksack River	U. S. Forest Service	0.05	39/8E	SWNE	1	Dom.
4432	2497	1077	6-25-37	Lookout Creek	U. S. Forest Service	0.10	40/7E	SWSE	35	Dom.
5302	3224	1638	11-13-40	Trib. Bagley Lake	Mt. Baker National Forest	0.05	39/9E		19	Dom.
6014	3860	2068	4-27-44	Unnamed Stream Trib. N. Fork Nooksack River	State Highway Commission	0.10	40/8E	NESE	36	Dom.
6015	3861	2184	4-27-44	Unnamed Stream Trib. N. Fork Nooksack River	State Highway Commission	2.00	40/8E	SENE	36	Power
7670	5263	2901	3-8-47	Unnamed Spring	W. Brown	0.01	39/7E	NENW	7	Dom.
8485	5857	3719	6-18-48	Cascade Creek	L. F. Becker	0.15	39/7E	Govt Lot 5	1	Power & Dom.
8624	5951	3341	10-15-48	Maple Creek	Mt. Baker National Forest	0.06	40/7E	SWSW	33	Com. Dom.
15006	11747		8-20-57	Unnamed Stream	Baptist Gen'l Convention of Oregon Washington	1.00	40/6E	SENW	27	Com. Dom.
				Separate Drainages Within Nooksack River Drainage						
				Willey Lake Drainage Area						
8887	6818	4193	7-6-49	Willey Lake	R. S. Ellis	0.40	40/2E	SWSW	27	Irr. 40 Ac.
9196	6319	3751	11-7-49	Willey Lake	M. Jensen	0.50	40/2E	SWSW	27	Irr. 80 Ac. & Dom.
10053	7407	4696	1-8-51	Willey Lake	J. Monahan	0.40	40/2E	SESE	28	Irr. 40 Ac.
				Unnamed Slough Drainage						
14948	12096	7757	7-30-58	Unnamed Slough	R. R. Knutzen	0.60	40/2E	Govt Lot 2	25	Irr. 60 Ac.
14997	11229		8-15-58	Unnamed Slough	G. Talmage	0.50	40/2E	SWSE	25	Irr. 50 Ac.
				Lake Fazon Drainage						
11633	8580	5106	8-29-52	Fazon Lake	J. Ulrich	0.35	39/3E	W½SW	13	Irr. 35 Ac.
14010	10404	6981	8-6-56	Fazon Lake Outlet	E. K. Ahrens	0.28	39/3E	NENW	13	Irr. 30 Ac.
14035	10578	6895	8-17-56	Fazon Lake	C. Zamzow	0.10	39/3E	SW	13	Irr. 15 Ac.
14078	10559		9-14-56	Fazon Lake & Springs	R. J. Needham	0.51	39/3E	SESW & NENW	13 24	Irr. 50 Ac. & Dom.

NOOKSACK RIVER BASIN DRAINAGE

Separate Drainages Within Nooksack River Drainage (Continued)

Unnamed Brook Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	Subdivision	Sec.	Use
13322	10215		3-2-55	Unnamed Pond	D. D. Allison	0.56	39/4E	W½NW	28	Irr. 55 Ac. & Dom.
14083	10524	7599	7-17-56	Spring-fed Pond	R. W. Carbee	0.22	39/4E	SESE	29	Irr. 20 Ac.

Germans Creek Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
6143	4023	2433	9-9-44	Germans Creek	G. Straka	0.27	41/5E	N½SE	36	Irr. 26 Ac. & Dom.
8890	6096	4370	7-7-49	Unnamed Spring	R. N. Heller	0.015	41/6E	SWSE	31	Dom.

COASTAL AREA DRAINAGE

Dakota Creek Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
1607	645	902	2-8-26	Spring Branch Cr.	A. Benefield	0.10	40/2E	W½SE	7	Irr. 3 Ac. & Dom.
3923	2112	889	1-17-34	Spring Branch Cr.	R. B. LeCocq	0.10	40/2E	NWSW	8	Irr. 6 Ac. & Dom.
4598	2632	1165	8-20-38	Dakota Creek	H. M. Whitford	0.10	40/1E	NWSE	15	Irr. 7 Ac.
5708	3587		6-11-42	N. Fork Dakota Cr.	J. V. Thompson	0.03	40/1E	SWSW	13	Irr. 2 Ac. & Dom.
6822	4424	3212	12-24-45	Unnamed Stream	J. A. Bingman	0.01	40/1E	NWNE	10	Dom.
7723	5474	3298	3-31-47	Dakota Creek	W. E. Pendleton	0.30	40/1E	SENE	15	Irr. 30 Ac.
8249	5702	4596	2-25-48	S. Fork Dakota Cr.	J. Leland	0.24	40/1E	NENW	24	Irr. 24 Ac.
10225	7466	5306	4-5-51	Spring Branch Cr.	R. B. LeCocq	0.50	40/2E	W½SW	8	Irr. 60 Ac.
10718	7777	4982	9-11-51	N. Fork Dakota Cr.	M. Lyle Honrud	0.18	40/1E	NENW	13	Irr. 18 Ac.
11410	8332	5462	6-2-52	N. Fork Dakota Cr.	M. O. Honrud	0.15	40/1E	NENE	13	Irr. 15 Ac.
12676	9663	6021	12-1-53	Olason Reservoir	S. Olason	0.70	40/1E	NWSE	5	Irr. 60 Ac.
15183	11460		11-24-58	Unnamed Spring	J. P. Mutch	0.20	40/1E	SWNW	10	Irr. 20 Ac.

California Creek Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
4531	2625		5-27-38	California Creek	J. Hills	0.5	40/1E	SESE	35	Irr. 80 Ac.
6151	3993	2274	9-18-44	Unnamed Creek	S. N. Friborg	0.20	40/1E	NWNE	20	Irr. 20 Ac.
7617	4996	3436	1-29-47	Ditch District #7	C. R. Behme	0.07	40/1E	NENE	35	Irr. 7 Ac.
10441	7526	4850	6-27-51	Unnamed Stream	C. Smith	0.01	39/1E	NENW	12	Dom.
11146	8114	5311	3-14-52	Unnamed Creek	P. Holtzheimer	0.17	40/1E	NWSW	21	Irr. 17 Ac.
12955	9734	6982	6-2-54	Ditch District #7	P. L. James	0.25	40/1E	SESW	25	Irr. 25 Ac.
15125	11243		10-10-58	Unnamed Brook	H. L. Carter	0.10	39/1E	SWSE	12	Irr. 10 Ac.
15179	11244	7495	10-15-58	Pond	L. Ferrill	0.18	39/1E	NWSW	1	Irr. 18 Ac.
R15401			4-17-59	Pond	S. Timmermans	9 ac-ft	40/1E	NENE	33	Irr. 20 Ac.

Unnamed Stream Tributary of Georgia Strait

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
13623	10244	7473	10-4-55	Unnamed Spring	N. R. Townsend	0.36	39/1E	W½NW	20	Irr. 38 Ac.

Unnamed Stream Tributary Birch Bay

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
5511	3511	3177	7-15-41	Unnamed Stream	O. G. Cook	0.25	40/1E	SENW	29	Irr. 30 Ac. & Dom.
15447	11422	7774	5-7-59	Unnamed Stream	D. R. Halzer	0.02	40/1E	S½NE	30	Dom. & Stock

Unnamed Spring Tributary Drayton Harbor

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
13935	10403	6676	6-22-56	Unnamed Spring	R. M. Foster	0.01	40/1W	Govt Lot 1	13	Dom.

Unnamed Stream Tributary Drayton Harbor

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
14843	11106		6-9-58	Unnamed Spring	E. G. Westman	0.50	40/1E	SWSW	8	Irr. 20 Ac. & Fish
15036	11192		9-2-58	Unnamed Creek	H. T. Johnson	0.02	40/1E	SESE	7	Stock & Dom.

Terrell Creek Drainage Tributary Birch Bay

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	T.R.	Subdivision	Sec.	Use
R9652	R158	4055	6-2-50	Terrell Creek	Department of Game	5600 ac-ft	39/1E		16	Fish & Wild
12547	10273	7336	9-1-53	Unnamed Stream	E. Krause	0.60	39/1E	W½SW	6	Irr. 60 Ac.
R13043	R190	6706	7-27-54	Fingalson Creek	V. F. Smrekar	24 ac-ft	39/1E	SESE	4	Irr. 15 Ac. & Wild
15068	11249		9-9-58	Med-O-Land Res.	P. J. Unruh	0.40	39/1W	SESE	1	Irr. 25 Ac.
R15069	R226		9-9-58	Unnamed Stream	P. J. Unruh	20 ac-ft	39/1W	SESE	1	Reservoir

COASTAL AREA DRAINAGE

Lummi (Red) River Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	(Subdivision)	(Sec.)	Use
8413	5838	3921	5-21-48	Lummi(Red)River	F. Brys	0.74	39/2E	NWSE	31	Irr. 74 Ac.
10521	7897	5165	7-23-51	Schell Ditch	G. Schaeffer, Jr.	0.35	39/1E	E½SE	25	Irr. 35 Ac.
11279	8195	5839	4-25-52	Lummi(Red)River	P. Hood	1.60	38/2E	Govt Lot 5	6	Irr. 160 Ac.
12916	9723	6066	4-21-54	Unnamed Ditch & Lummi(Red)River	F. Beck	0.16	39/1E 39/2E	SESE SWSW	36 31	Irr. 76 Ac.
15758	11746		11-6-59	Intermittent Stream	N. Nubgaard	0.50	39/1E	NESE	24	Irr. 50 Ac.

Silver Creek Drainage

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	(Subdivision)	(Sec.)	Use
1959	907	368	1-7-27	Silver Creek	Sunset Water Company	0.11	39/2E	SESE	34	Dom. Supplies
2004	925	918	2-17-27	Silver Creek	J. Aberg	0.016	39/2E	SWSW	34	Irr. 1 Ac. & Dom.
2027	910	199	3-7-27	Silver Creek	Andreas & Haselwood	0.02	39/2E	NWSE	34	Dom.
2395	1313	354	8-21-28	Silver Creek	S. W. Monroe	0.01	39/2E	SESE	34	Dom. & Stock
Certificate of Change		530	8-21-28	Silver Creek	A. E. Boyd	0.05	39/2E	SESW	35	Irr. 5 Ac.
3636	1903	1049	5-16-32	Silver Creek	G. Cross	0.015	39/2E	SWSE	34	Irr. 1.5 Ac. & Dom.
5755	3622	1929	7-27-42	Andreason Ditch	G. LaBounty	0.02	39/2E	NWSW	35	Dom. & Garden
6616	4363	2575	8-22-45	Silver Creek	R. Stephens	0.10	39/2E	SWSW	35	Irr. 20 Ac.
7242	4990	4123	6-13-46	Andreason Ditch	G. LaBounty	0.01	39/2E	NWSE	35	Dom.
7255	4837	2690	6-15-46	Andreason Ditch	E. Erickson	0.005	39/2E	NWSW	35	Dom.
7305	5024	4316	7-5-46	Silver Creek	F. Smith	0.1	38/2E	SENW	4	Irr. 10 Ac. & Dom.
8213	5564	3993	2-6-48	Silver Creek	E. F. Peterson	0.25	39/2E	NWSW	34	Irr. 30 Ac.
8434	5824	3332	6-1-48	Tennant Lake	E. D. Beckover	0.40	39/2E	SESE	29	Irr. 50 Ac.
12497	9618		8-10-53	Unnamed Spring	J. Sherin	0.09	38/2E	SENE	4	Irr. 9 Ac.
12726	9492	5734	1-19-54	Unn. Trib. Bear Cr.	C. A. Taylor	0.01	38/2E	NWNE	11	Stock & Fish
14087	10580	7034	9-21-56	Silver Creek	H. Gerard	0.01	39/2E	SESE	34	Irr. 0.5 Ac.
14780	11057		3-14-58	Bear Creek	E. R. Tjomsland	0.21	38/2E	S½N½	2	Irr. 20 Ac. & Stock
15101	11304		9-18-58	Unn. Reservoir	C. V. Wilder	1.60	39/2E	NWSW	36	Irr. 160 Ac.
R15102			9-18-58	Unnamed Springs	C. V. Wilder	30 ac-ft	39/2E	NWSW	36	Storage for Irrigation

Lummi Island Drainages

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	(Subdivision)	(Sec.)	Use
9740	7128	6143	7-3-50	Unnamed Stream & Spring	F. A. Baker	2.22	37/1E	NWNE	22	Irr. 200 Ac., Power & Dom.
11572	8647	5184	7-6-52	Unnamed Stream	Sunrise Cove Water Dev.	0.13	37/1E	NESE	15	Com. Dom.
12535	9364	5625	8-27-53	Unnamed Stream	L. H. Parberry, Sr.	0.005	37/1E	Govt Lot 3	10	Dom.
13465	10088	6729	6-9-55	Unnamed Spring	M. Granger	0.005	38/1E	NWSE	32	Stock
15673	11671		9-8-59	2 Unnamed Streams	L. D. Niedhamer	1.00	37/1E	Govt Lot 2 & SESW	24	Com. Dom.
15781			11-25-59	Unnamed Stream	A. J. & E. G. McMillan		37/1E		23	Com. Dom.
R15782			11-25-59	Unnamed Stream	A. J. & E. G. McMillan		37/1E		23	Com. Dom.

SUMAS RIVER BASIN DRAINAGE

Sumas River

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R.)	(Subdivision)	(Sec.)	Use
2147	1113	1302	8-23-27	Sumas River	H. E. Scheib	0.10	40/4E	SWSW	16	Irr. 4.5 Ac.
*5216	3184	2139	7-31-40	Sumas River	F. Englehart	0.25	40/4E	SWSW	11	Irr. 20 Ac.
6855	4482	2693	1-16-46	Sumas River	W. H. McRea	0.20	40/4E	NESE	15	Irr. 20 Ac.
7173	4936	3610	5-25-46	Sumas River	F. J. Wildberger	0.25	40/4E	S½S½ & NWNE	2 11	Irr. 25 Ac.
7220	4729	2907	6-7-46	Sumas River	P. Biehle	0.30	40/4E	SWSE	16	Irr. 30 Ac.
7263	4953	3113	6-19-46	Sumas River	L. E. Edwards	0.15	41/4E	Govt Lot 8	35	Irr. 15 Ac.
7355	4751	4962	7-31-46	Sumas River	P. Ostrum	0.12	40/4E	NWSW	21	Irr. 12 Ac.
7591	5000	2857	1-13-47	Sumas River	G. A. Hanowell	0.30	40/4E	W½E½	20	Irr. 30 Ac.
7716	6262	4132	3-27-47	Sumas River	L. M. Parratt	0.03	40/4E	SENE	20	Irr. 3 Ac.
7776	5573	3612	4-24-47	Sumas River	A. D. Banner	0.36	40/4E	SESE	20	Irr. 46 Ac.
8460	5842	3279	5-25-48	Sumas River	A. L. Olsen	0.20	40/4E	NENE	20	Irr. 30 Ac.
10994	8010	5014	1-24-52	Sumas River	E. Froberg	0.60	41/4E	NWSW	36	Irr. 60 Ac.
11032	8003	5039	2-7-52	Sumas River	J. Willemsen	0.20	40/4E	SWNW	15	Irr. 20 Ac.
11145	8082	4807	3-13-52	Sumas River	D. Leenders	0.38	40/4E	NWSW	15	Irr. 38 Ac.
11286	8168	4854	4-28-52	Sumas River	J. Fadden	0.20	41/4E	Govt Lot 3	36	Irr. 20 Ac.
11417	8379	6532	6-3-52	Sumas River	F. Dean	0.55	40/4E	SWNW	14	Irr. 55 Ac.
11852	8688	5885	11-24-52	Kales Slough	J. Vos	0.35	39/4E	NENE	8	Irr. 40 Ac.
14186	10608		1-9-57	Sumas River	J. Lautenbach	0.80	39/4E	NENE	5	Irr. 80 Ac.
14644	10977	7536	1-27-58	Sumas River	M. J. Honcoop	0.35	40/4E	SESE	16	Irr. 35 Ac.

* Certificate in error--change required.

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R. Subdivision Sec.)			Use

SUMAS RIVER BASIN DRAINAGE

Saar Creek Drainage

Tributaries Saar Creek

3351	1718	704	4-14-31	Anderson Lake	J. O. Anderson	1.50	40/5E	NENW	7	Power, Dom. & Dairy
8183	5561	3527	1-15-48	Unnamed Stream	C. E. Mathes	0.02	40/5E	NWSE	18	Fish Pond

Sumas Drainage Ditch Tributary Sumas River

7589	4952	3112	1-6-47	Sumas Drainage Ditch	L. E. Edwards	0.29	41/4E	Govt Lots 1 & 2	35	Irr. 29 Ac.

Johnson Creek Drainage

Johnson Creek Tributary Sumas River

6132	3923	2946	8-30-44	Johnson Creek	W. Swanson	0.20	40/4E	NWSW	4	Irr. 20 Ac.
9968	7093	4291	10-30-50	Johnson Creek	A. E. Swanson	0.36	40/4E	SWSE	5	Irr. 36 Ac.
10518	7882	4793	7-20-51	Johnson Creek	J. M. Hammingh	0.15	40/4E	NWNE	3	Irr. 15 Ac.
10743	7898	5087	9-29-51	Johnson Creek	J. C. Jager	0.50	40/4E	NENW	3	Irr. 50 Ac.
10825	7866	4958	10-22-51	Johnson Creek	J. E. Hagin	0.60	40/4E	NENW	8	Irr. 60 Ac.
10919	8007	5075	12-12-51	Johnson Creek	P. Dykstra	0.45	40/4E	SWNE	4	Irr. 55 Ac.
Certrificate of Change 504					P. Dykstra					
11095	8094	6299	2-25-52	Johnson Creek	E. Tyrrell	0.33	40/4E	Govt Lot 2	3	Irr. 25 Ac.
13456	10073	6984	6-3-55	Johnson Creek	F. Westhoff	0.36	40/4E	NWNE	8	Irr. 36 Ac.
15282	11322		2-11-59	Johnson Creek	P. VanWeerdhuizen	0.33	40/4E	W½	3	Irr. 33 Ac.

Springs Tributary Johnson Creek

6973	4592		3-14-46	Spring	Town of Sumas	1.34	41/4E	SWSW	33	Municipal Supply
6974	4593	3427	3-14-46	Spring	Town of Sumas	1.78	40/4E	Govt Lot 1	33	Municipal Supply

Pangborn Creek Tributary Johnson Creek

8271	5847	3936	3-11-48	Bostwick Creek	L. L. Bostwick	0.40	40/4E	SWNW	5	Irr. 65 Ac.
9516	6725	4405	4-11-50	Pangborn Creek	R. Van Dyken	0.12	40/3E	NESE	1	Irr. 12 Ac.
10774	7864	6125	10-3-51	Pangborn Ditch	J. Otter	0.29	40/3E	NWSW	1	Irr. 29 Ac.
11058	8013	5243	2-13-52	Pangborn Creek	F. Higgenson	0.40	40/4E	NWSW	6	Irr. 40 Ac.

Clearbrook Creek Tributary Johnson Creek

7368	4954	3897	8-6-46	Clearbrook Creek	G. Hinton	0.30	40/4E	NESE	7	Irr. 37 Ac. & Dom.
12822	9650	6805	3-22-54	Clearbrook Creek	R. Boese	0.30	40/4E	NWSE	7	Irr. 35 Ac.
15359	11438	7647	3-25-59	Unnamed Pond (no outlet)	O. L. Russell	0.15	40/4E	SENE	7	Irr. 15 Ac.

Squaw Creek Tributary Johnson Creek

2029	993	852	3-9-27	Squaw Creek	E. A. Knittle	0.50	40/3E	SWNW	12	Irr. 40 Ac.
4654	2638	2373	10-13-38	Squaw Creek	J. H. Bruns.	0.40	40/3E	SENW	12	Irr. 20 Ac.
7074	4545	3760	4-25-46	Unnamed Creek	S. Johnson	0.40	40/3E	NESE	12	Irr. 40 Ac.
7432	4955	3896	9-5-46	Squaw Creek	G. H. Hinton	0.20	40/4E	NESE	7	Irr. 20 Ac.

Kinney Creek Drainage

12297	9192		4-27-53	Kinney Creek	L. J. Ross	0.25	40/4E	N½NW	22	Irr. 25 Ac.

Breckenridge Creek Drainage

4218	2347	1303	4-13-36	Breckenridge Creek	T. Velthuisen	0.10	40/4E	S½NE	28	Irr. 40 Ac.
Certificate of Change 619					T. Velthuisen					
4239	2452	1576	6-12-36	Elkins Creek	C. Simpson Adams	0.05	40/4E	NESE	28	Irr. 15 Ac.
13890	10658		5-28-56	Breckenridge Creek	J. D. Bartel	0.40	40/4E	NENE	24	Irr. 40 Ac.

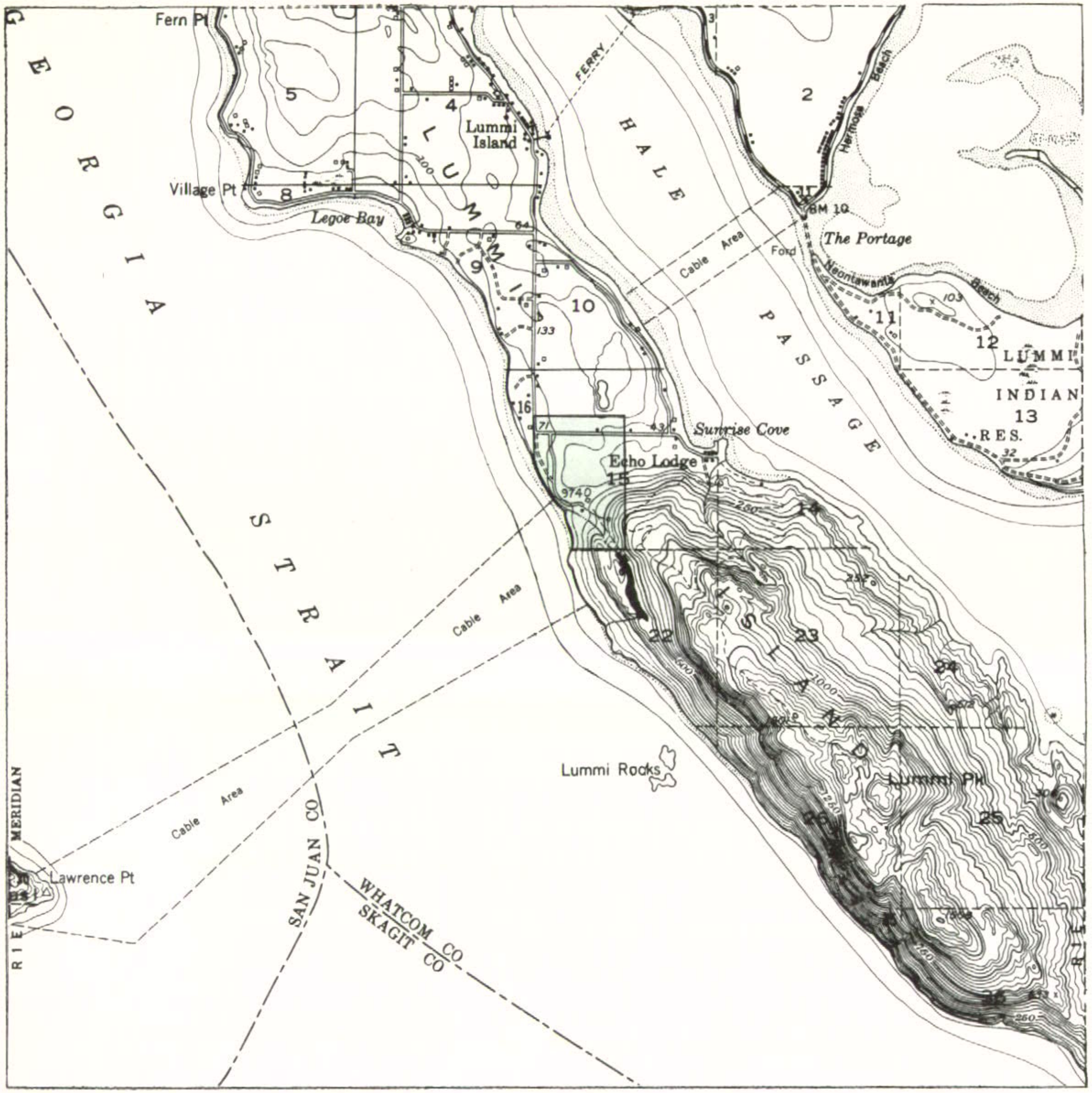
Swift Creek Drainage

13841	10342		5-11-56	Swift Creek	B. Hardin	0.41	40/4E	NESW	34	Irr. 40 Ac. & Dom.

Appl.	Permit	Cert.	Priority	Source	Name	Quantity (cfs)	Location of Point of Diversion (T.R. Subdivision Sec.)			Use
				SUMAS RIVER BASIN DRAINAGE						
				Goodwin Creek Drainage						
6335	4385	2428	3-2-45	Goodwin Creek	H. M. Ingersoll	0.02	39/4E	SWSW	3	Irr. 2.5 Ac., Dom. & Stock
12447	9229	6616	7-8-53	Goodwin Creek	G. DeKoekkoek	0.30	40/4E	NESW	33	Irr. 30 Ac.
12576	9537	7279	9-15-53	Goodwin Creek	T. E. Skinner	0.33	40/4E	N½SE	33	Irr. 38 Ac.
14935	12087		7-25-58	Goodwin Ditch	B. Holz	0.25	39/4E	Govt Lot 2	4	Irr. 40 Ac.
14947	12065		7-30-58	Unnamed Spring	C. Gorrie	0.30	40/4E	SESE	33	Irr. 30 Ac.
				Judson Lake Within Sumas River Drainage						
11287	8291	6631	4-28-52	Judson Lake	A. & H. Nordlund	0.20	41/4E	Govt Lot 7	31	Irr. 20 Ac.
15257	11350		1-23-59	Unnamed Ditch & Judson Lake	A. Holmquist	1.00	41/3E	Govt Lot 5	36	Irr. 100 Ac.
15784	11699		11-27-59	Judson Lake	H. G. Loreen	0.30	41/4E	Govt Lot 2	31	Irr. 30 Ac.

APPENDIX C

Appendix C consists of 18 maps each showing the lands covered by irrigation rights in a specific township. This appendix is based on the two preceding appendices and pictorially shows the place of irrigation use. Although an entire farm may be shown as being covered by irrigation rights, only a check of appendix A or B, as the case may be, will accurately determine the extent of a specific right.



EXPLANATION

Land covered under ground water right, and associated point of withdrawal

Land covered under surface water right, and associated point of diversion

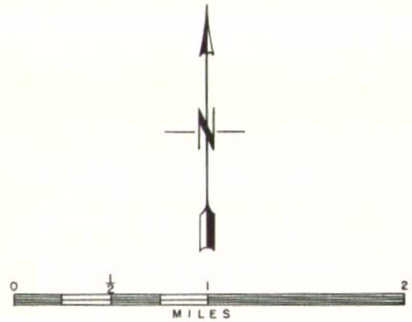
Land covered under both surface and ground water rights

Point of withdrawal with land area too small to be outlined

Point of diversion with land area too small to be outlined

Number adjacent to point of diversion or withdrawal refers to water right application number

Base maps are U. S. G. S. Topographic Quadrangles



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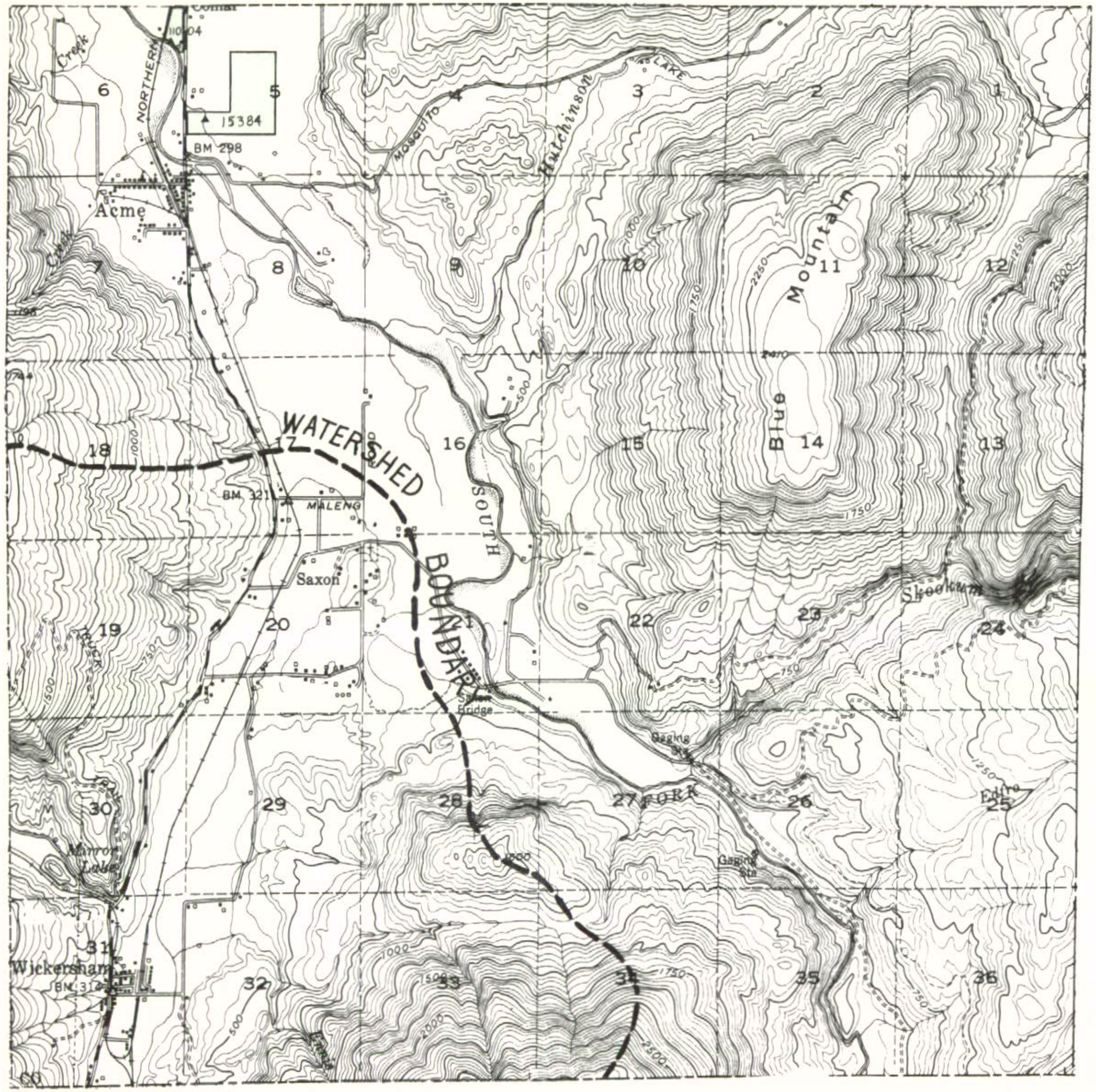

EXPLANATION

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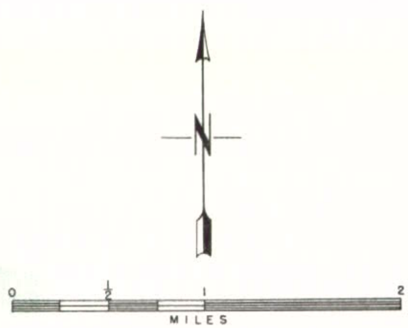

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APPENDIX

EXPLANATION

Land covered under ground water right, and associated point of withdrawal

Land covered under surface water right, and associated point of diversion

Land covered under both surface and ground water rights

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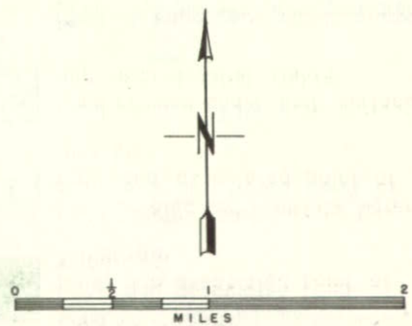

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EXPLANATION

- Land covered under ground water right, and associated point of withdrawal
- Land covered under surface water right, and associated point of diversion
- Land covered under both surface and ground water rights
- Point of withdrawal with land area too small to be outlined
- Point of diversion with land area too small to be outlined

Number adjacent to point of diversion or withdrawal refers to water right application number

Base maps are U. S. G. S. Topographic Quadrangles

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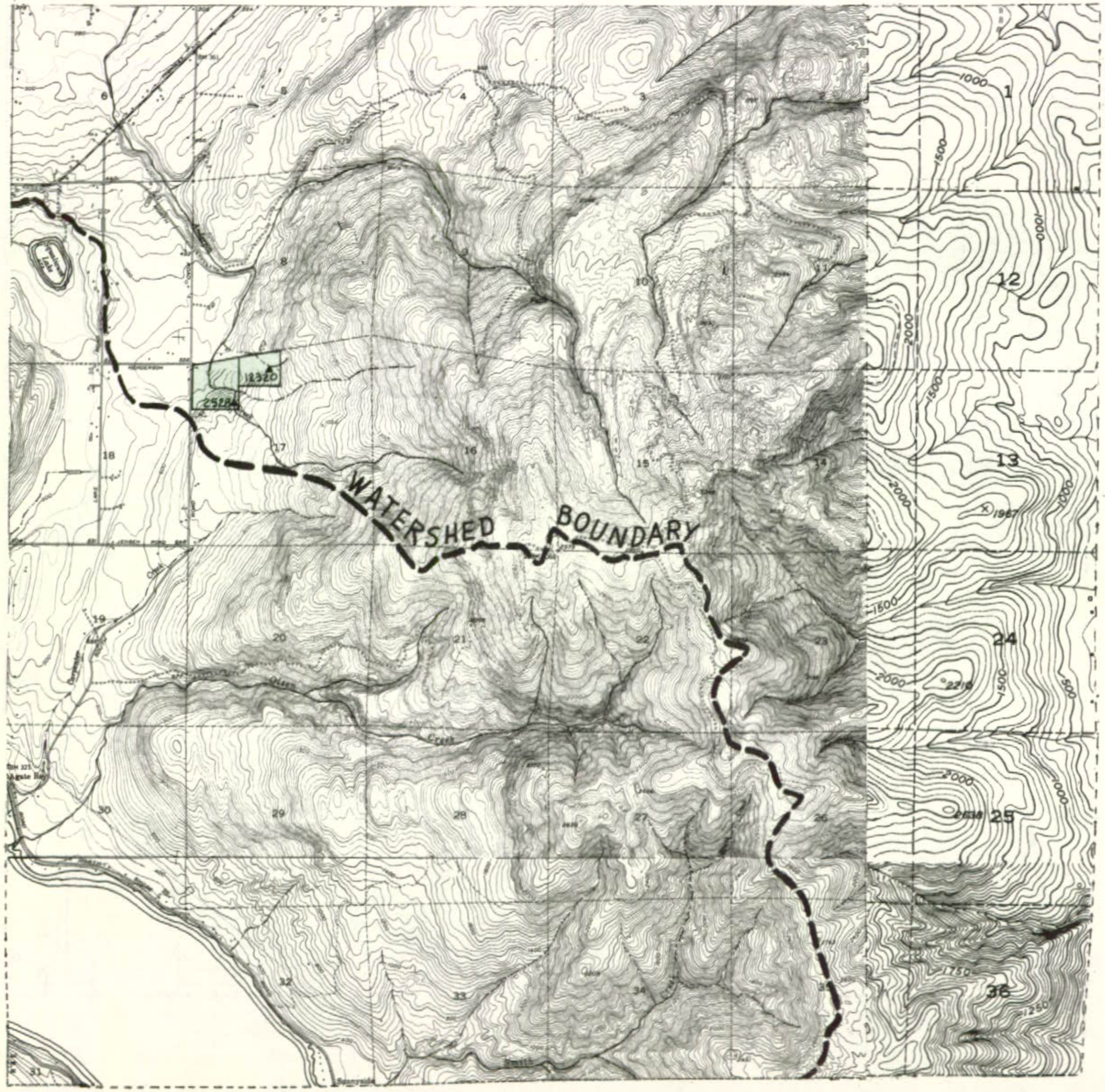

EXPLANATION

Land covered under ground water right, and associated point of withdrawal

Land covered under surface water right, and associated point of diversion

Land covered under both surface and ground water rights

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N

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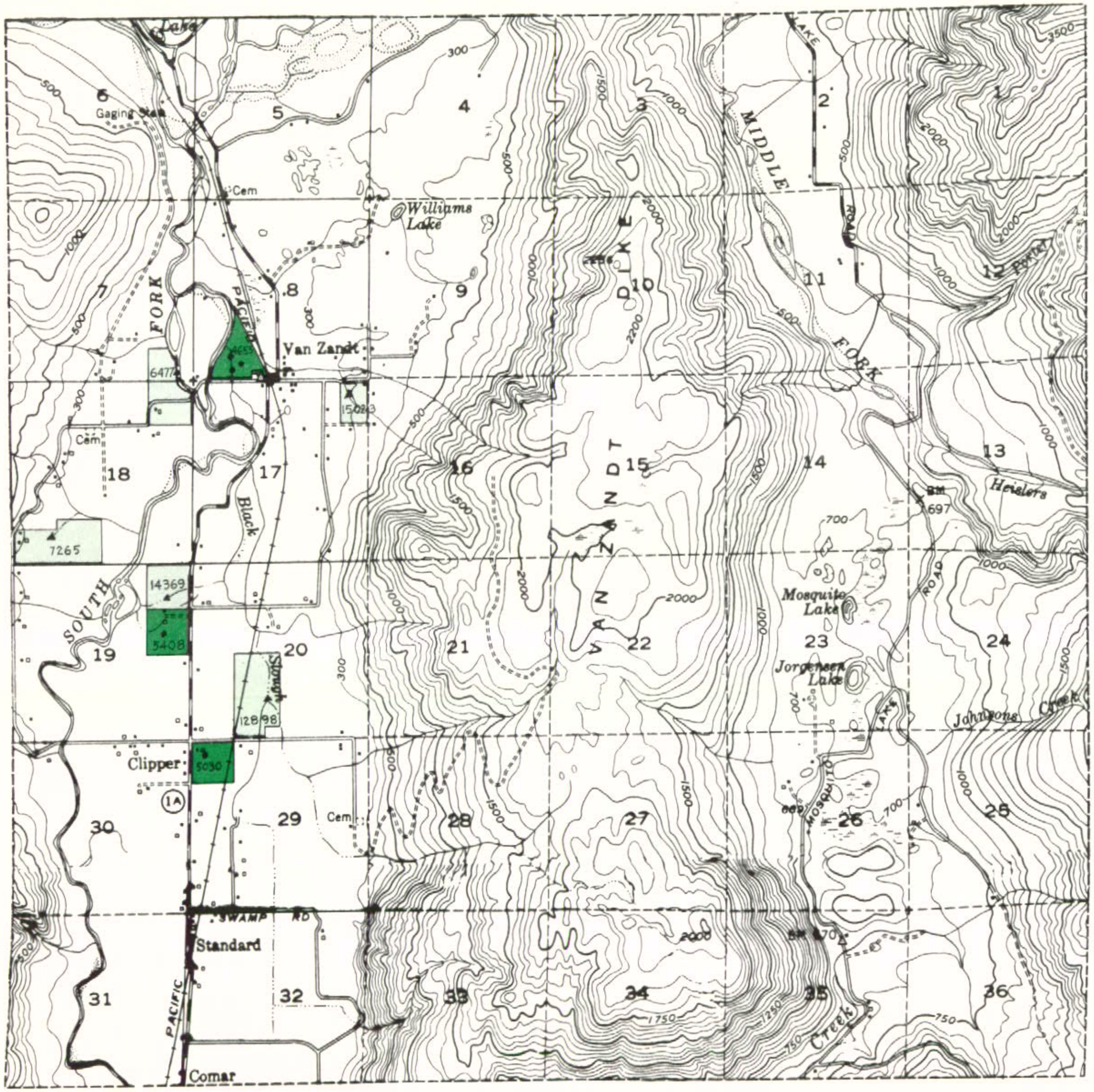
MILES

T 38 N R 4 E



EXPLANATION

Land covered under ground water right, and associated point of withdrawal

Land covered under surface water right, and associated point of diversion

Land covered under both surface and ground water rights

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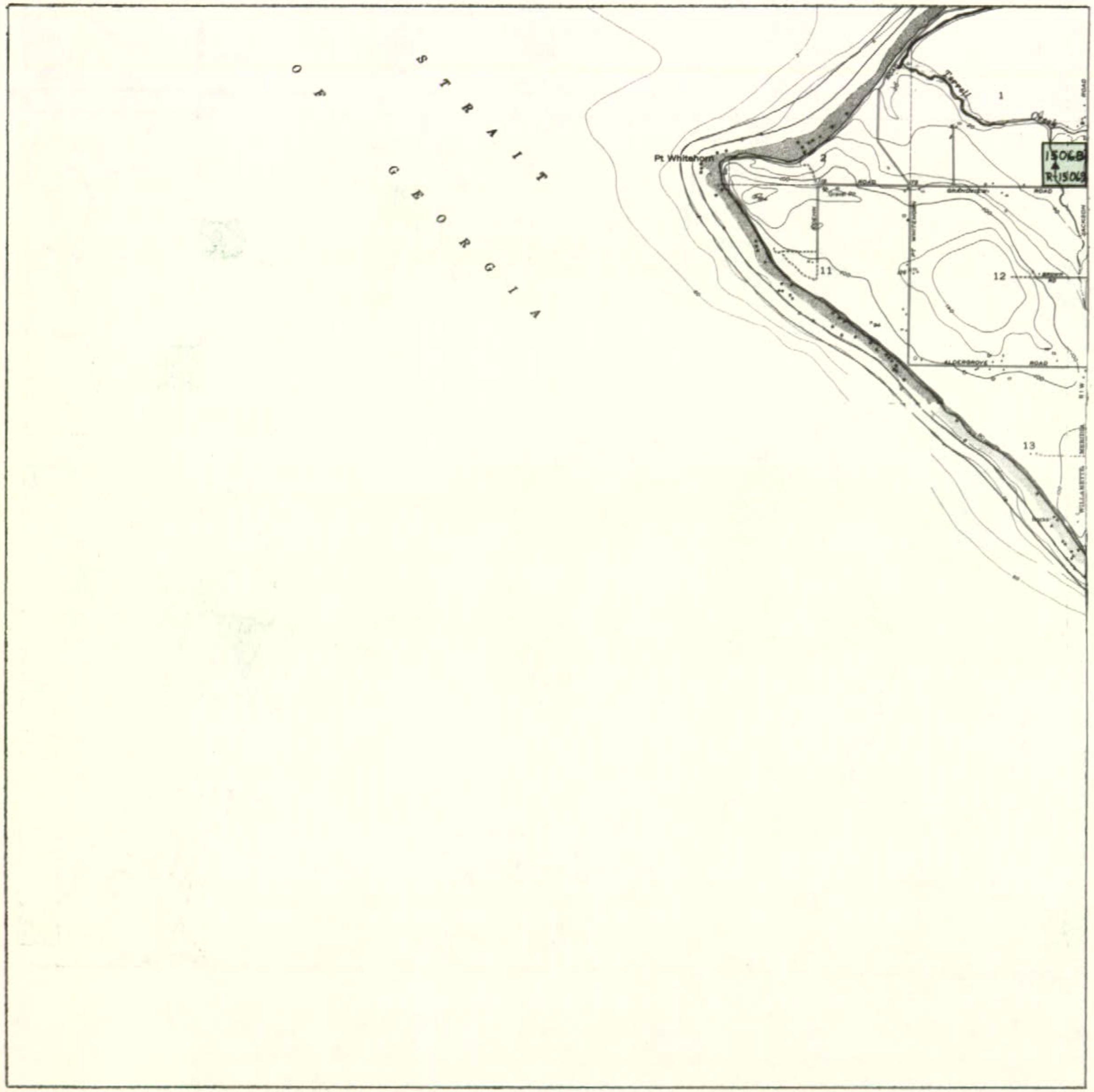
T 38 N R 5 E



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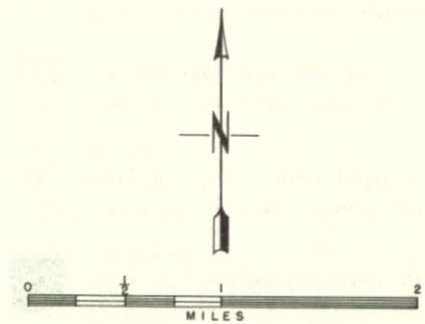

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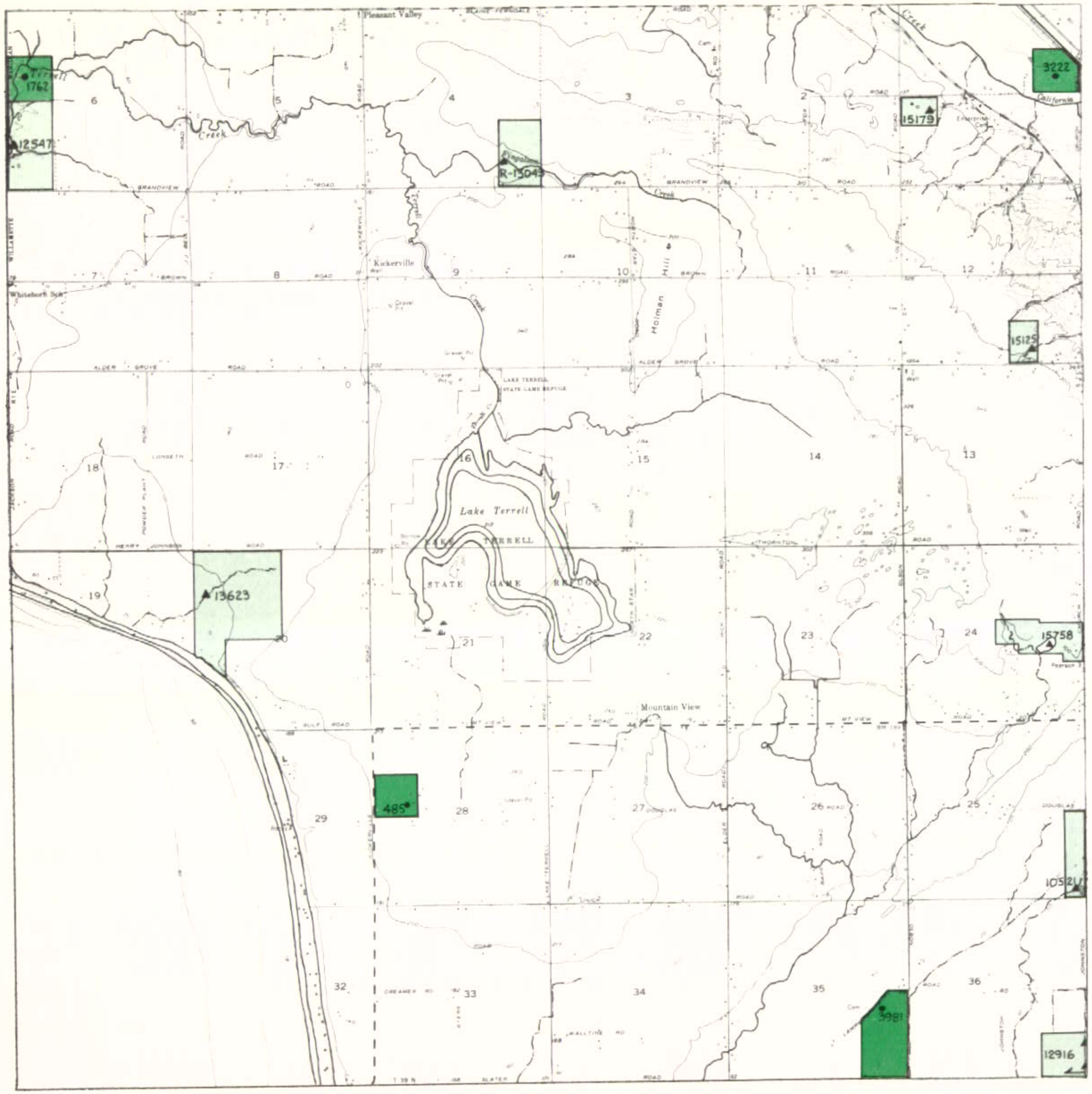

EXPLANATION

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Land covered under surface water right, and associated point of diversion

Land covered under both surface and ground water rights

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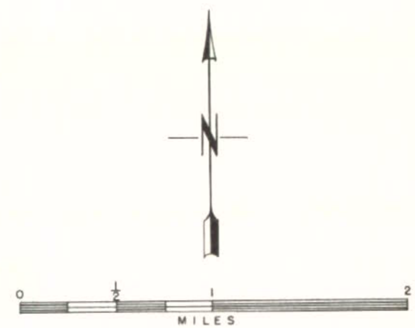

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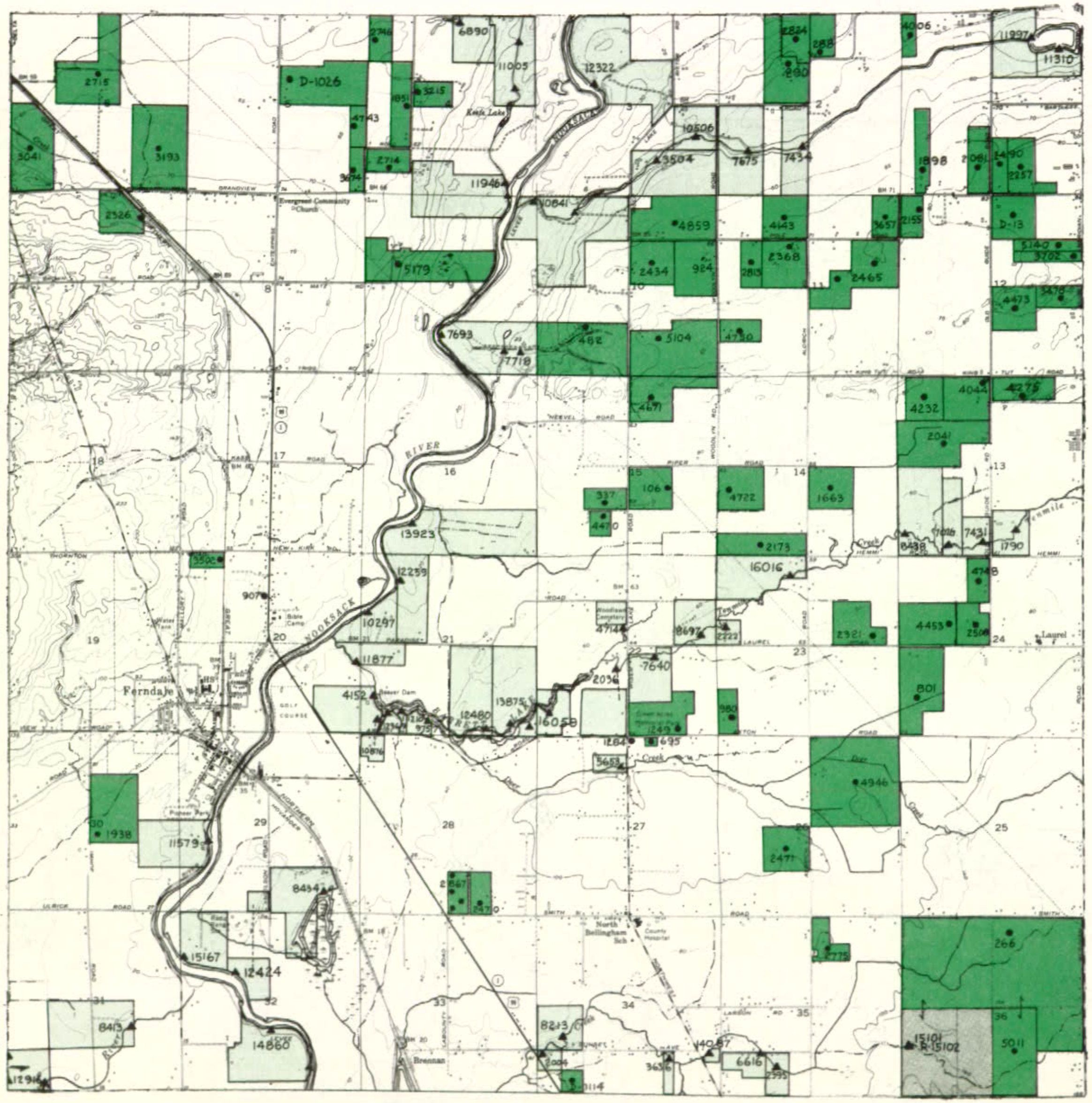

EXPLANATION

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Land covered under surface water right, and associated point of diversion

Land covered under both surface and ground water rights

Point of withdrawal with land area too small to be outlined

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Base maps are U. S. G. S. Topographic Quadrangles

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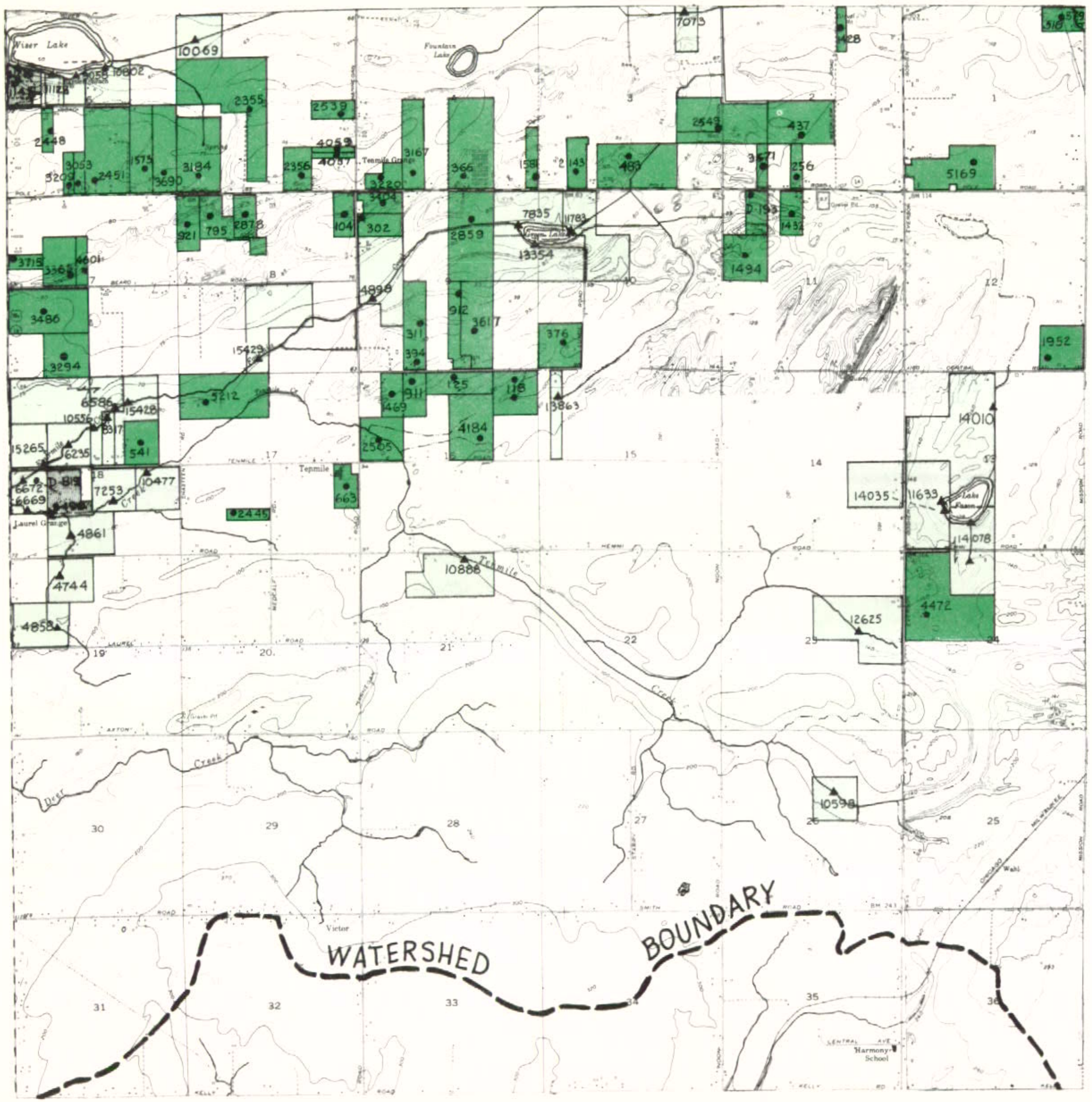
MILES

T 39 N R 2 E



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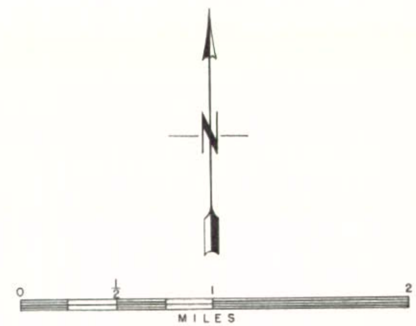

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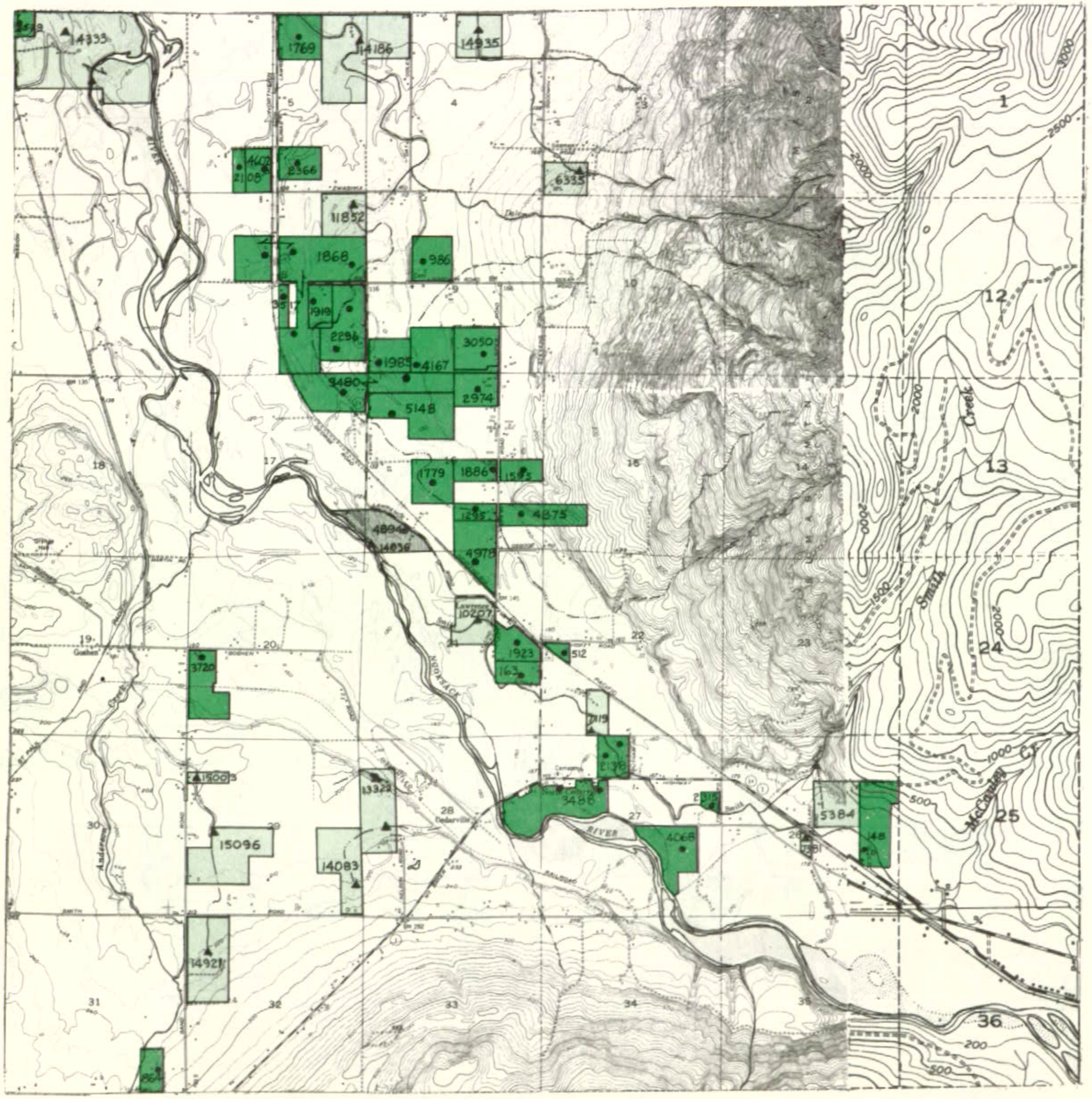

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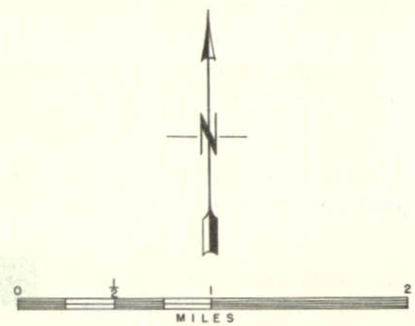

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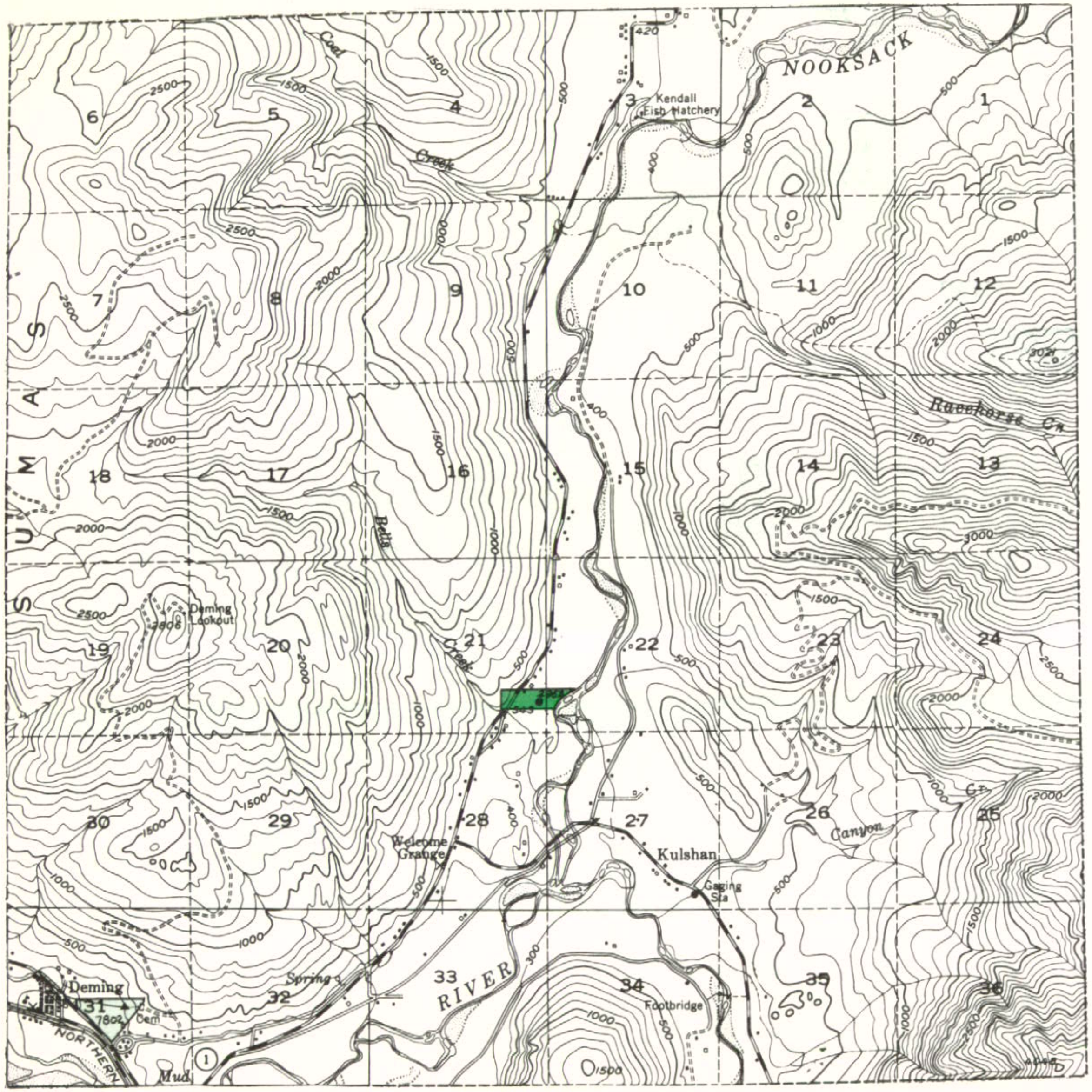

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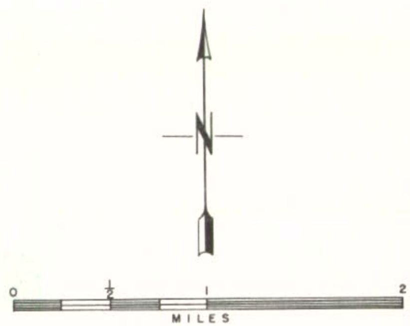
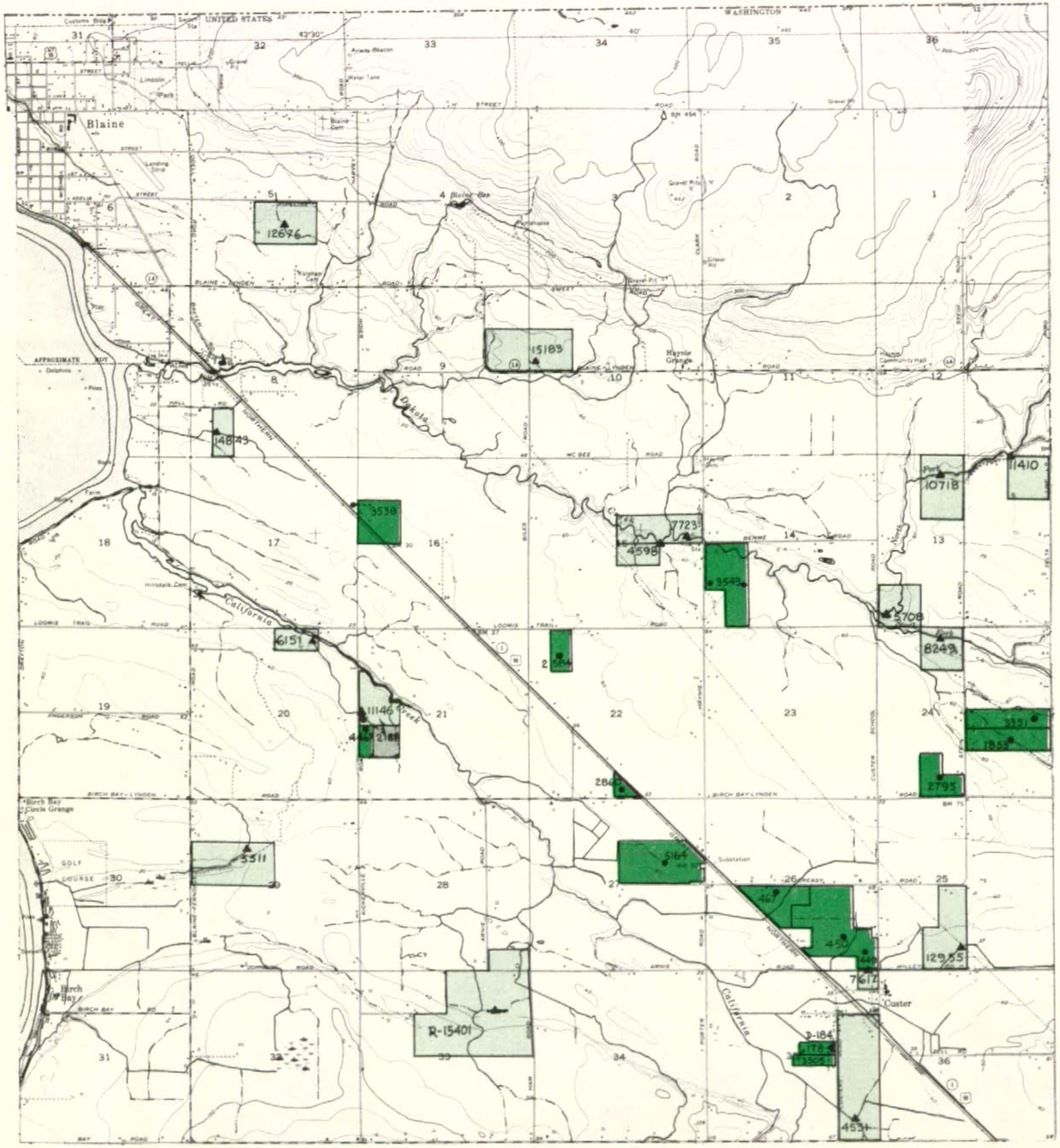


T 39 N R 5 E

APPENDIX



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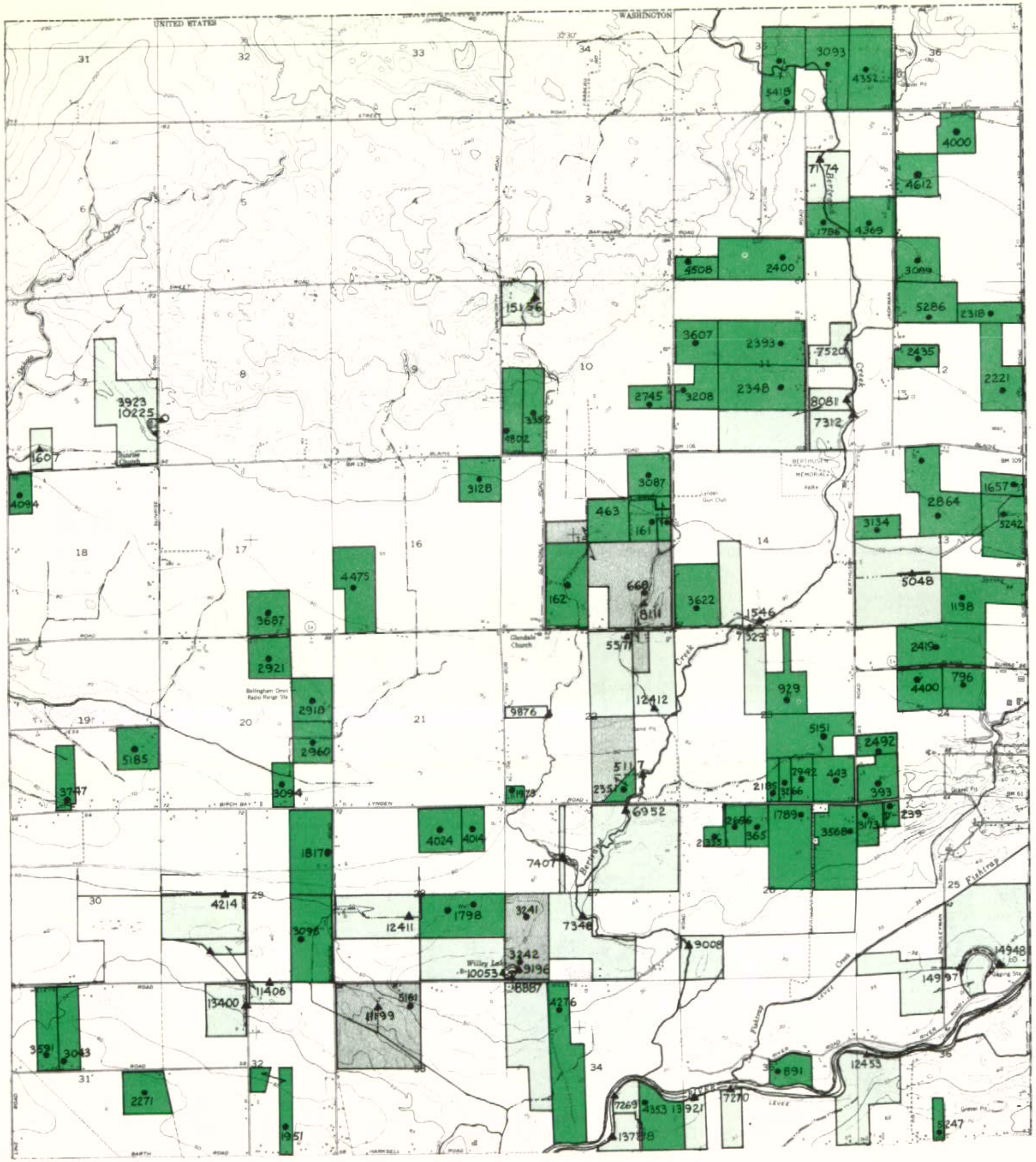
MILES

T40 & 41N R1E



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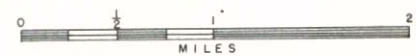
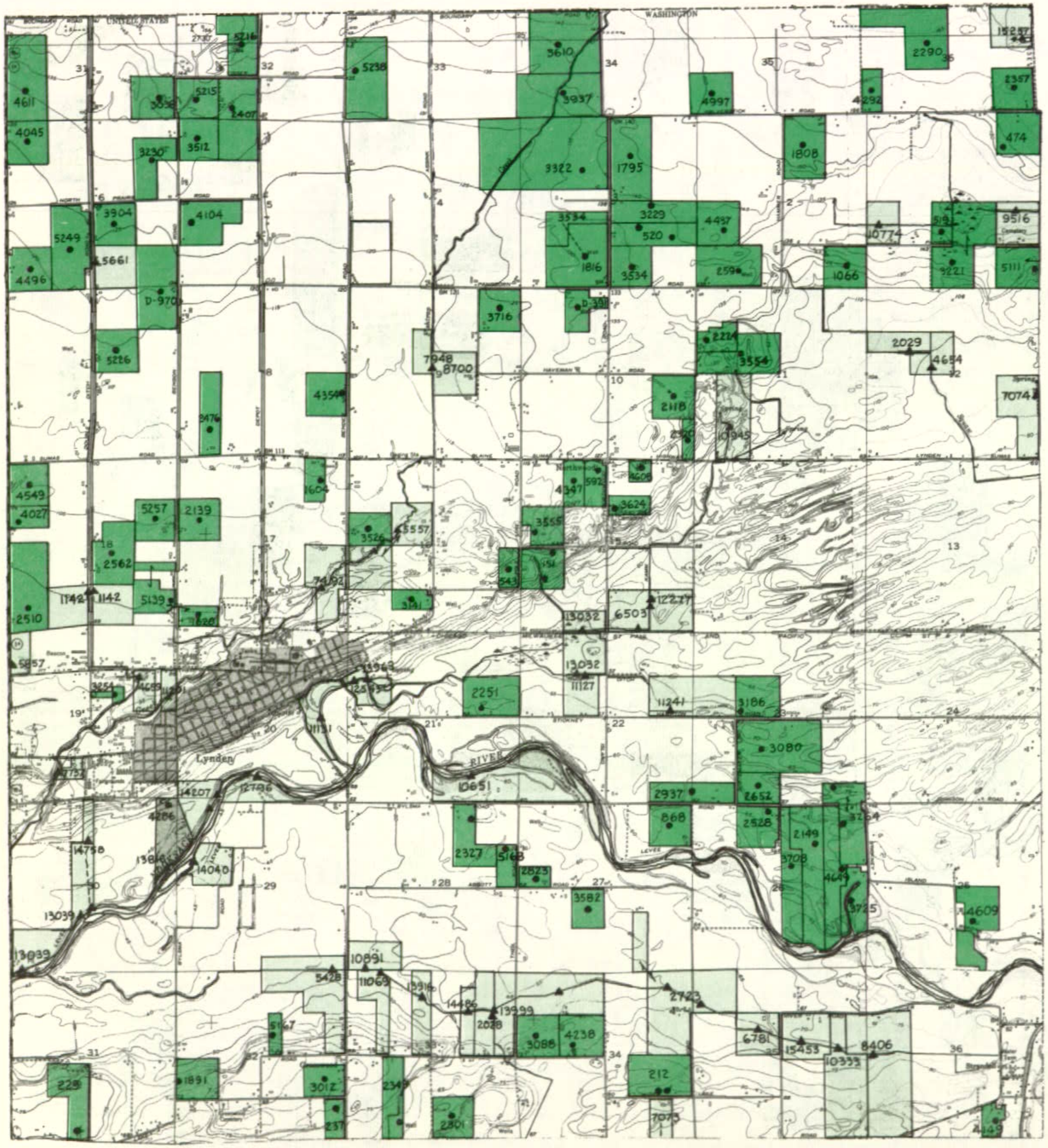


T40 & 41 N R2E



EXPLANATION

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Land covered under surface water right, and associated point of diversion

Land covered under both surface and ground water rights

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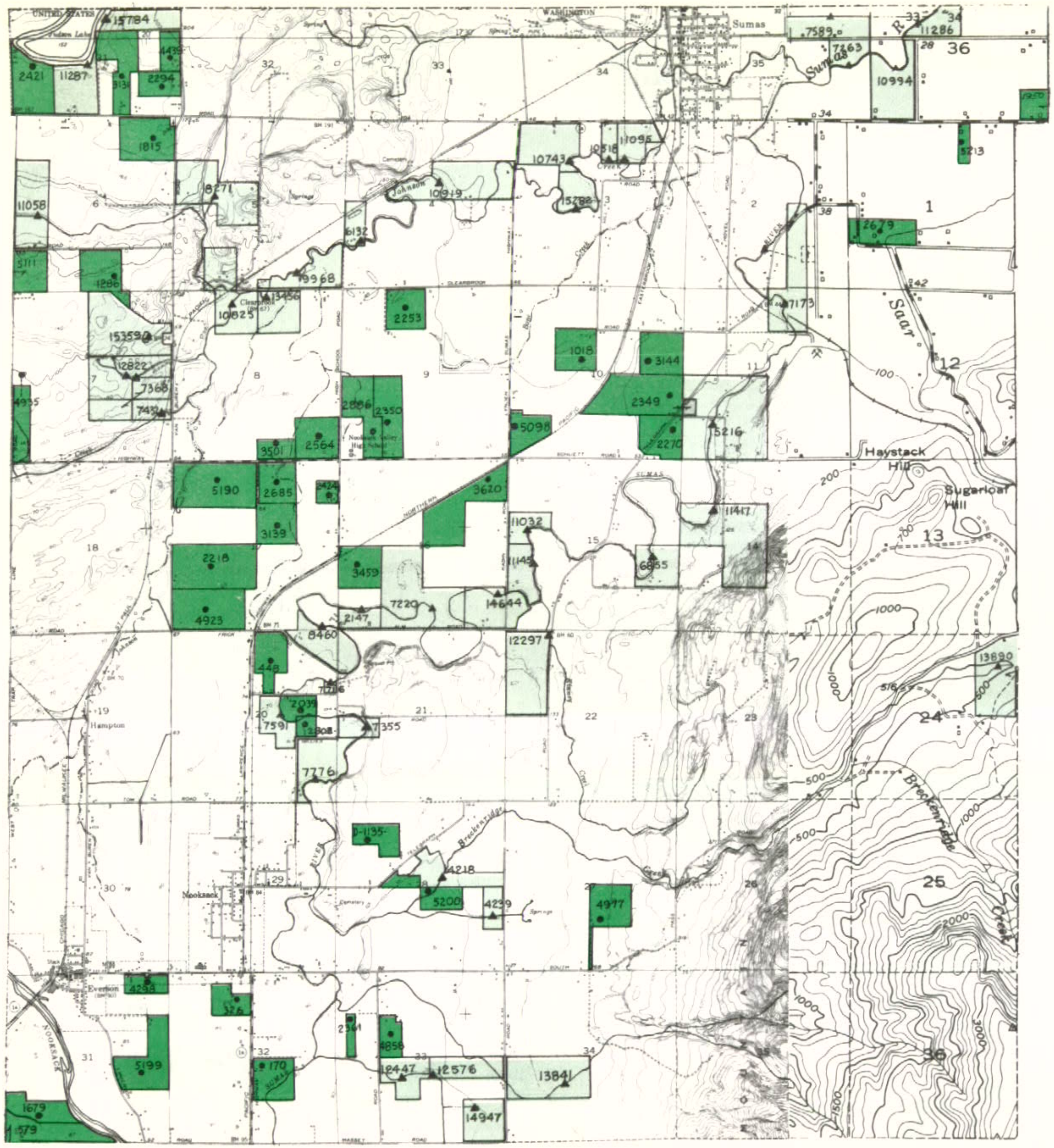
MILES

T40 & 41 N R 3 E



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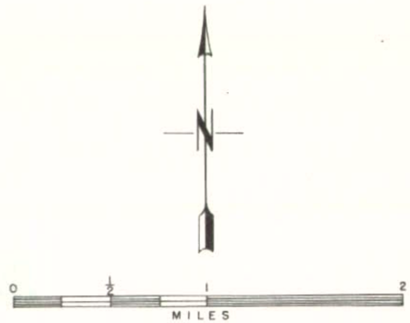
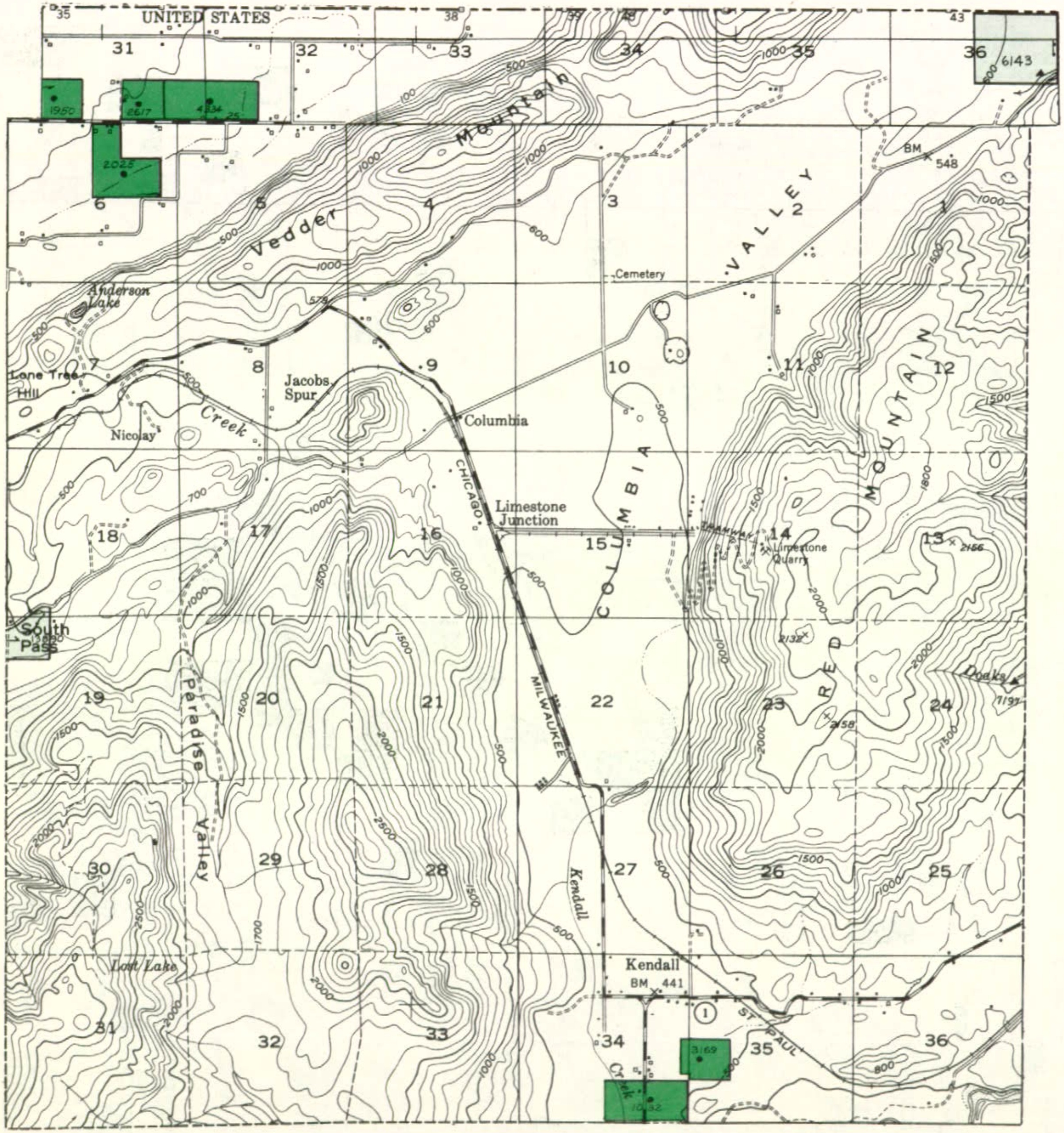


T40 & 41N R4E



EXPLANATION

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Point of diversion with land area too small to be outlined

Number adjacent to point of diversion or withdrawal refers to water right application number

Base maps are U. S. G. S. Topographic Quadrangles

0 ½ 1 2
MILES

T40 & 41N R5E

EXPLANATION

Land covered under ground water right, and associated point of withdrawal

Land covered under surface water right, and associated point of diversion

Land covered under both surface and ground water rights

Point of withdrawal with land area too small to be outlined

Point of diversion with land area too small to be outlined

Number adjacent to point of diversion or withdrawal refers to water right application number

Base maps are U. S. G. S. Topographic Quadrangles

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MILES

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